

PRACTICE EXAM 7: RED SEAL 310S SIMULATION (125 QUESTIONS)

1. The WHMIS 2015 pictogram showing a skull and crossbones identifies products that:
 - A. Are acutely toxic and may cause death from a small single exposure
 - B. Are flammable liquids requiring storage in approved metal cabinets
 - C. May cause long-term health effects only after years of repeated exposure
 - D. Are corrosive to metal containers and require special handling

2. When a vehicle is parked on a four-post drive-on hoist (with wheels on the runways) and lifted with the engine off, wheel chocks should be:
 - A. Placed only at the front wheels of the vehicle being serviced
 - B. Placed only at the rear wheels of the vehicle being serviced
 - C. Placed on both sides of one wheel that remains on the hoist runway
 - D. Not required because the hoist's lift arms hold the vehicle securely

3. To legally service automotive air conditioning systems in Canada, a technician must:
 - A. Pass a generic shop safety exam at any approved training facility
 - B. Hold an Environment and Climate Change Canada (or provincial) refrigerant handling certification
 - C. Be licensed by Transport Canada to transport flammable refrigerants
 - D. Carry no special certification beyond the Red Seal automotive certification

4. When servicing older brake or clutch components that may contain asbestos, the technician should:

- A. Use compressed air to blow dust off the parts before any inspection
- B. Use a dry brush to sweep dust away from the parts during cleaning
- C. Replace components without cleaning to avoid asbestos exposure
- D. Use a HEPA-vacuum or wet method to control airborne fibres during cleaning

5. After handling used motor oil, brake fluid, or coolant, the technician should:

- A. Wash hands thoroughly with soap and water before eating, drinking, or smoking
- B. Wipe hands with a clean shop rag to remove any visible fluid contamination
- C. Apply hand lotion immediately to prevent skin drying from the chemicals
- D. Use compressed air to blow contaminants off skin before continuing work

6. A shop's vehicle exhaust ventilation system is required because:

- A. Engine noise during testing exceeds permissible workplace levels significantly
- B. Vehicle exhaust contains carbon monoxide and other harmful gases that accumulate indoors
- C. Engine heat can damage shop equipment if not vented from the work area
- D. Exhaust vapours mark vehicle paint and cause finish discoloration over time

7. The WHMIS 2015 pictogram showing a dead tree and fish identifies products that are:

- A. Toxic only if ingested in large quantities by humans
- B. Flammable in the presence of plant or biological materials
- C. Corrosive to vegetation and wildlife in concentrated form
- D. Hazardous to the aquatic environment if released to water systems

8. Used lead-acid batteries from automotive service must be:

- A. Disposed of in regular shop garbage bins as non-hazardous waste
- B. Drained of electrolyte before disposal to reduce hazardous content
- C. Returned to a licensed battery recycling facility through proper channels
- D. Stored indefinitely in the shop until the customer requests pickup

9. A workplace first aid kit in a Canadian shop must contain:

- A. Prescription pain medications and antibiotic ointments for cuts and injuries
- B. Items specified in the provincial first aid regulations for the shop's size
- C. Only items the shop owner personally selects based on perceived risk
- D. Identical contents regardless of provincial or federal workplace standards

10. An engine has a cylinder displacement of 500 cc and a combustion chamber volume of 50 cc at TDC. The compression ratio is:

- A. 11:1
- B. 10:1

C. 9:1

D. 12:1

11. Piston-to-bore clearance is measured to determine:

A. The compression ratio of the engine for tuning calibration purposes

B. Whether the piston rings have the correct end gap clearance values

C. The engine's stroke length compared to the bore diameter for displacement

D. The gap between the piston skirt and the cylinder wall for proper fit

12. Plastigage is used during engine assembly to measure:

A. The valve clearance between the rocker arm and the valve stem tip

B. The crankshaft endplay at the thrust bearing during final assembly

C. The clearance between bearing journals and their corresponding bearings

D. The piston ring end gap when installed in the cylinder bore

13. Cylinder honing during an engine rebuild serves what primary purpose?

A. Removes the cylinder ridge at the top of the bore from previous wear

B. Creates a crosshatch pattern in the bore to seat new piston rings properly

C. Reduces the cylinder diameter to match smaller replacement pistons

D. Tests the cylinder for cracks before the engine is reassembled

14. After crankshaft journal regrinding, the engine assembler must:

- A. Replace all main and rod bearings with standard-size bearings only
- B. Use the same bearings that were removed during the disassembly process
- C. Run the engine for 1,000 km before applying full power for break-in
- D. Install undersize bearings (e.g., 0.010" undersize) to match the new journal diameter

15. Camshaft "lift" refers to:

- A. The total time the valve is open during one engine cycle measured in degrees
- B. The distance from the base circle of the cam lobe to the camshaft centerline
- C. The number of degrees of crankshaft rotation during which the valve is open
- D. The maximum distance the valve opens from its closed position, in millimetres or inches

16. Valve spring "installed height" must be measured during engine rebuild because:

- A. It determines the engine's compression ratio when valves are seated closed
- B. It indicates the camshaft lift specification at maximum lobe opening
- C. It determines whether shims are needed to maintain proper spring pressure on the seat
- D. It measures the gap between the valve stem tip and the rocker arm at zero lash

17. On an engine with solid (mechanical) valve lifters, valve lash is checked and adjusted:

- A. With the engine cold or at the specified temperature, with the cam lobe on its base circle for that valve
- B. With the engine running at idle and the valve cover removed for visual inspection
- C. With the engine off and the camshaft positioned so the cam lobe is at maximum lift
- D. With the engine cranking at low speed and the rocker arm in motion across the cam lobe

18. Cylinder head pressure testing detects:

- A. The maximum compression pressure the head can sustain during operation
- B. Cracks or porosity in the coolant or oil passages of the cylinder head
- C. The thickness of the cylinder head deck face before resurfacing operations
- D. The correct torque specification for the cylinder head bolts at assembly

19. The pressure relief valve in an engine oil pump:

- A. Stops oil flow completely when engine oil pressure exceeds the specification
- B. Drains oil from the engine if pressure drops below the minimum during operation
- C. Routes oil to the filter bypass valve when the filter becomes blocked
- D. Opens to return excess oil to the oil pan when pressure exceeds the calibrated limit

20. An engine oil cooler functions to:

- A. Increase engine oil viscosity by heating it during cold start operation
- B. Filter contaminants from the engine oil through a separate filter element

- C. Transfer heat from engine oil to engine coolant (or to ambient air) to control oil temperature
- D. Pressurize the engine oil supply to the main bearings during operation

21. A coolant level sensor in the surge tank or radiator illuminates a dashboard warning when:

- A. The coolant level drops below a calibrated minimum, indicating possible leak or low fill
- B. The coolant temperature rises above the normal operating range significantly
- C. The coolant pressure exceeds the system relief pressure setting
- D. The coolant flow rate drops below the minimum required for cooling

22. A cooling system pressure test is performed by:

- A. Removing the radiator cap and measuring pressure at the inlet hose connection
- B. Pressurizing the system through the radiator cap opening with a hand pump and gauge
- C. Measuring the temperature differential across the radiator inlet and outlet
- D. Removing the thermostat and measuring coolant flow rate at idle

23. A fuel pressure gauge is most commonly connected to a fuel-injected engine at:

- A. The fuel pump electrical connector through a special adapter
- B. The fuel tank vent valve at the EVAP system connection point
- C. The fuel filter inlet by tapping into the supply line during operation
- D. The Schrader (test port) valve on the fuel rail or a tee fitting in the supply line

24. A fuel pump's current draw test is performed to:

- A. Determine the fuel pressure the pump is producing at the rail under load
- B. Verify the fuel injector pulse width and the duty cycle during idle
- C. Compare the actual current to specification, identifying wear or restriction
- D. Test the resistance of the fuel pump circuit at the connector terminals

25. On a modern oxygen sensor, the internal heater circuit:

- A. Pre-heats the engine coolant before the sensor reaches operating temperature
- B. Heats the sensor element to operating temperature (typically 600 °C or higher) for accurate signal output
- C. Heats the exhaust gas to a calibrated reference temperature for measurement
- D. Provides a backup voltage signal in case the sensor fails during cold operation

26. An EGR cooler is included on modern diesel and some gasoline engines to:

- A. Reduce the temperature of recirculated exhaust gas before it enters the intake
- B. Heat the exhaust gas to optimal combustion temperatures during cold start
- C. Filter particulate matter from the exhaust gas before recirculation
- D. Pressurize the exhaust gas to prevent backflow in the EGR system

27. A DPFE (Differential Pressure Feedback EGR) sensor measures:

- A. The mass flow rate of EGR gas through the EGR valve directly
- B. The temperature differential across the EGR cooler during operation
- C. The position of the EGR valve pintle in the EGR pipe at any time
- D. The pressure difference across a metering orifice in the EGR pipe to calculate EGR flow

28. When cleaning a mass airflow (MAF) sensor, the technician must use:

- A. Carburetor cleaner sprayed liberally on the sensor element for full cleaning
- B. A specialized MAF sensor cleaner formulated to not damage the sensor wire
- C. Compressed air at maximum pressure to blow contaminants off the wire
- D. Solvent and a cotton swab to physically wipe the sensor element clean

29. On a modern gasoline direct injection (GDI) system, the fuel injector pulse width is typically:

- A. Measured in seconds because GDI injects fuel continuously during operation
- B. Constant at all engine speeds because GDI uses fixed-volume injectors
- C. Measured in milliseconds, varying with engine load and operating conditions
- D. Measured in minutes during sustained highway cruise operation

30. A VVT (variable valve timing) oil control solenoid can be tested by:

- A. Energizing the solenoid with battery voltage and verifying it clicks open audibly or with a stethoscope
- B. Measuring the engine vacuum across the solenoid during idle operation

- C. Checking the solenoid output pressure with a hydraulic pressure gauge
- D. Connecting a tachometer and observing RPM change when the solenoid actuates

31. Hydraulically-actuated Electronically-controlled Unit Injectors (HEUI), used on some older diesel engines, differ from common-rail injectors by:

- A. Operating at higher fuel pressures than common-rail systems during full load
- B. Using lower oil pressures during start-up procedures for cold starts
- C. Injecting fuel directly from the fuel tank without going through any rail
- D. Using engine oil pressure (amplified internally) to generate the injection pressure

32. When measuring CAN-H to ground with the network at rest (idle), the voltage should typically be:

- A. Approximately 5V on CAN-H to ground with the bus at idle
- B. Approximately 2.5V on CAN-H to ground with the bus at idle
- C. Approximately 0V on CAN-H to ground at any condition
- D. Approximately 12V on CAN-H to ground with the bus at idle

33. On an oscilloscope, a healthy CAN bus during data transmission shows:

- A. A pure DC voltage on both CAN-H and CAN-L with no variation at all
- B. A constant 5V AC sinusoidal waveform on both CAN-H and CAN-L lines
- C. CAN-H pulsing upward and CAN-L pulsing downward from a 2.5V reference simultaneously
- D. CAN-H and CAN-L both pulsing in the same direction synchronously

34. With the vehicle's ignition off and battery negative disconnected, the resistance measured between CAN-H and CAN-L on a high-speed CAN bus should be:

- A. Approximately 60 ohms (the parallel combination of two 120-ohm terminators)
- B. Approximately 120 ohms (a single terminator at one end of the bus)
- C. Approximately 240 ohms (the series combination of two 120-ohm terminators)
- D. Open circuit because the modules are powered off during the measurement

35. Modern CAN networks use which CAN identifier (CAN-ID) format?

- A. Only the 8-bit standard CAN-ID format for all modern vehicles
- B. Either 16-bit short or 32-bit long depending on the manufacturer's design
- C. Only the 64-bit extended format for vehicles built since 2020
- D. Either 11-bit standard or 29-bit extended depending on the application

36. When a CAN module enters "bus-off" state due to excessive transmit errors, recovery typically requires:

- A. Replacement of the module that entered bus-off because it is permanently failed
- B. An ignition cycle (key off then on) to reset the module's error counters
- C. Removing and reinstalling the module's connector by hand
- D. Disconnecting the entire vehicle network for at least 24 hours

37. On a vehicle network, a diagnostic message sent to functional address 0x7DF (in UDS over CAN):

- A. Targets only the powertrain control module specifically by VIN
- B. Targets only the body control module on most modern vehicles
- C. Targets all OBD-II-compliant modules; any module that supports the requested service responds
- D. Provides a wireless OTA update channel through the cellular gateway

38. When the key is turned off, modern vehicles "shed" electrical loads in a controlled sequence to:

- A. Allow modules to complete write operations to memory and transition to sleep mode safely
- B. Maximize the discharge of the battery during overnight parking to maintain charge
- C. Trigger the alarm system immediately for security on key-off
- D. Activate the door lock system before any other action takes place

39. If a module reprogramming session is interrupted (e.g., by a power loss), the result is most commonly:

- A. The module reverts to its previous calibration automatically without service action
- B. The vehicle continues to operate normally with the partially-flashed module
- C. The PCM recognizes the failure and prompts the scan tool to retry the flash
- D. The module is left in a partially-flashed (often unrecoverable) state, requiring further service

40. The LIN (Local Interconnect Network) bus operates at a maximum speed of approximately:

- A. 500 kbps to handle moderately fast comfort system data
- B. 20 kbps for low-cost, low-bandwidth comfort and convenience subsystems

- C. 1 Mbps for safety-critical applications on heavy-duty vehicles
- D. 10 Mbps for multimedia applications on luxury vehicles

41. On modern vehicles, the fiber-optic MOST network is being replaced by:

- A. Wireless Wi-Fi communication between infotainment components only
- B. Single-wire CAN for low-cost backward compatibility with old systems
- C. Automotive Ethernet (e.g., 100BASE-T1 / BroadR-Reach) for high-bandwidth applications
- D. CAN-FD running at the maximum data rate for streaming use

42. OBD-II Mode 02 (service \$02) retrieves:

- A. Freeze frame data captured when a confirmed DTC was set in the PCM
- B. The list of pending DTCs from the most recent drive cycle on the vehicle
- C. Permanent DTCs that cannot be cleared by a scan tool reset operation
- D. Real-time data from the PCM through the OBD-II protocol stream

43. Compared to Classic CAN, CAN-FD (Flexible Data Rate) provides:

- A. The same data rate but at a longer maximum cable length than Classic CAN
- B. Higher data rates in the data phase and larger frame payloads, with backward CAN compatibility
- C. A completely incompatible physical layer requiring all-new wiring on the vehicle
- D. Lower data rates but improved noise immunity for critical applications

44. On a clutch hydraulic system with an adjustable master cylinder pushrod, the adjustment must:

- A. Maintain zero clearance between pushrod and master cylinder piston at rest
- B. Be set to maximum length to ensure full clutch disengagement during operation
- C. Be set to minimum length to keep clutch fully engaged when pedal is up
- D. Provide specified free play (typically 1–3 mm) between pushrod and master cylinder piston at rest

45. GL-5 gear oil should not be used in some manual transmissions because:

- A. GL-5 has lower viscosity than required for manual transmission operation
- B. GL-5 lacks the friction modifier required for clutch operation in the transmission
- C. The sulphur-phosphorus EP additives in GL-5 can corrode yellow-metal synchronizer components
- D. GL-5 is rated for lower temperatures than typical transmission operation

46. Many modern manual transmissions specify a "synchromesh" fluid because:

- A. The fluid is formulated for proper synchronizer operation and friction characteristics
- B. The fluid contains specific additives for limited-slip differential clutch packs
- C. The fluid is designed for use only in transfer cases with chain-drive systems
- D. The fluid replaces the need for an external transmission cooler in service

47. On a conventional automatic transmission with a sump filter, the filter is changed by:

- A. Removing the transmission oil pan to access the filter, then replacing both the filter and the pan gasket
- B. Unscrewing the filter from the front of the transmission like an oil filter on an engine
- C. Backflushing the filter through the transmission cooler return line with new ATF
- D. Sliding the filter out from a side port without removing the transmission oil pan

48. Automatic transmission cooler lines are typically:

- A. Made of rubber hose throughout the length of the cooler system path
- B. Steel tubes with flared or quick-connect fittings at the radiator and the transmission
- C. Made of plastic tubing for weight reduction in modern designs
- D. Welded into the radiator and transmission, requiring full radiator replacement if damaged

49. Differential side bearing (carrier bearing) preload is set using either:

- A. A crush sleeve, which deforms to apply the correct preload to both bearings
- B. The pinion nut torque, which controls both the pinion and carrier preload together
- C. Selective shims at each side, or threaded adjusters at each side, depending on the design
- D. A spring-loaded mechanism inside the differential housing that auto-adjusts

50. During differential rebuild, pinion depth is verified by:

- A. Painting the ring gear teeth with marking compound and inspecting the contact pattern after rotation
- B. Measuring the gap between the pinion gear tip and the carrier with a feeler gauge

- C. Counting the teeth on the pinion and dividing by the number on the ring gear
- D. Setting the pinion nut to a specific torque value and checking pinion runout

51. Ring gear runout is measured with:

- A. A torque wrench measuring rotational resistance through one ring gear rotation
- B. A pressure gauge connected to a hydraulic test port during operation
- C. Plastigage strips placed between the ring gear teeth and the carrier
- D. A dial indicator against the ring gear back face as the gear rotates one revolution

52. To disassemble a Rzeppa-style outer CV joint for cleaning or inspection, the technician:

- A. Pries the joint apart with a screwdriver, separating the inner and outer races at the bearing
- B. Removes the snap ring at the inner race, slides the joint off the axle, and tilts the cage to release the balls
- C. Heats the outer race to expand it, allowing the balls and cage to fall out the back
- D. Drills out the riveted retention pins holding the joint together permanently

53. To remove a front half-shaft from a FWD vehicle, the technician must first:

- A. Loosen the axle nut at the wheel hub (with vehicle on the ground to prevent rotation)
- B. Disconnect the half-shaft from the transmission case at the inboard end
- C. Remove the brake caliper assembly from the steering knuckle
- D. Drain the engine oil from the engine before any disassembly begins

54. When pressing a new U-joint into a driveshaft yoke, the press must contact:

- A. The center of the U-joint cross to apply equal force on both bearings
- B. The needle bearings inside the cap to seat them against the trunnion
- C. Only the outer surface of the bearing cup, transferring force into the yoke
- D. The retaining clip groove to lock the cup in place during installation

55. In a typical transfer case, low range gearing is most commonly achieved by:

- A. A separate idler shaft engaged when low range is selected from the cabin
- B. A larger pinion gear engaged in low range than the gear used in high range
- C. A chain drive with a different drive sprocket selected for low range only
- D. A planetary gearset that provides reduction (typically 2:1 to 2.7:1) when engaged

56. A viscous coupling AWD system differs from a Haldex-style coupling because:

- A. The viscous coupling uses an electric motor to engage the AWD function
- B. The viscous coupling engages passively via silicone fluid shear; Haldex uses electronically-controlled hydraulic clutch
- C. The viscous coupling uses a chain drive while Haldex uses a gear drive
- D. The viscous coupling only engages in 4-wheel-drive mode; Haldex is always engaged

57. On a modern reactive AWD system, when does the rear coupling typically begin to engage?

- A. When the front wheel speed exceeds the rear wheel speed by a calibrated threshold (slip detected)
- B. When the vehicle's engine reaches operating temperature during cold start
- C. When the driver presses a dashboard switch to engage AWD mode manually
- D. When the vehicle exceeds a specific speed (typically above 50 km/h)

58. During differential service, after draining the old gear oil, the technician should:

- A. Refill with whatever gear oil is available, since all gear oils are interchangeable
- B. Wait for the differential to fully cool before adding any new oil
- C. Refill with the manufacturer-specified type and the correct volume (typically 1.5–2.5 L)
- D. Add oil until it begins to flow out of the differential breather or vent

59. During pinion seal replacement, before removing the pinion nut, the technician should:

- A. Loosen the pinion nut completely to verify the threads are not stripped
- B. Inspect the seal for visible damage and decide if replacement is needed
- C. Drain the differential gear oil to prevent contamination during the service
- D. Mark the pinion nut and shaft position so the original preload can be restored after seal replacement

60. A failed clutch master cylinder seal typically allows:

- A. Air to enter the hydraulic system from the engine bay area
- B. Brake fluid to bypass internally, causing pedal pressure loss with no external leak

- C. Excessive fluid to be pushed back to the reservoir during normal clutch operation
- D. The clutch slave cylinder to operate at higher than normal pressure

61. Watt's Law ($\text{Power} = \text{Voltage} \times \text{Current}$) is used to calculate power consumption. A 12 V circuit drawing 5 amps consumes:

- A. 60 watts of power during operation
- B. 2.4 watts of power during operation
- C. 17 watts of power during operation
- D. 7 watts of power during operation

62. Three resistors in series of 2 ohms, 3 ohms, and 5 ohms have a total resistance of:

- A. 1 ohm (the parallel combination of the three values)
- B. 30 ohms (the product of all three values)
- C. 0.97 ohms (the parallel reciprocal of the three values)
- D. 10 ohms (the sum of all three values)

63. Two equal resistors of 10 ohms each in parallel produce a total resistance of:

- A. 20 ohms (the sum of the two values in series)
- B. 10 ohms (the same as a single resistor in either branch)
- C. 5 ohms (half the value of a single resistor of equal value)
- D. 100 ohms (the product of the two values)

64. When measuring the output frequency of a Hall-effect crankshaft sensor with the engine running, the DMM should be set to:

- A. DC voltage scale on the lowest available range for sensors
- B. Frequency (Hz) measurement scale on the meter
- C. Resistance (ohms) scale to test the sensor's internal resistance
- D. Capacitance (farads) scale to test the sensor's filter capacitor

65. A scope shows an injector signal with the injector ON for 4 ms during each 20 ms cycle. The duty cycle is:

- A. 20 percent (the on-time divided by total cycle time, expressed as percent)
- B. 5 percent (the on-time divided by total cycle time, expressed as percent)
- C. 4 percent (the on-time in milliseconds, expressed as percent)
- D. 80 percent (the off-time divided by total cycle time, expressed as percent)

66. Before each use, HV insulating gloves (Class 0 or higher) must be:

- A. Rinsed with water to remove any chemical residue from the previous use
- B. Stored in their original packaging only and never inspected by the user
- C. Disposed of as biohazard waste regardless of their visible condition
- D. Visually inspected and air-tested for leaks, with periodic recertification (typically every 6 months)

67. Battery "state of health" (SOH) differs from state of charge (SOC) because SOH measures:

- A. The current battery voltage compared to the nominal voltage value
- B. How fully charged the battery is at the moment of measurement
- C. The battery's remaining capacity compared to its original capacity when new
- D. The battery's specific gravity using a hydrometer in the cells

68. A "smart" battery charger differs from a trickle charger by:

- A. Operating at a higher charging current than a trickle charger always
- B. Adjusting charging voltage and current through stages (bulk, absorption, float) based on battery condition
- C. Charging only AGM batteries and not flooded batteries during use
- D. Requiring less than 10 minutes to fully charge a discharged battery

69. Headlamp vertical aim is verified using:

- A. A headlight aiming device or measured wall pattern at a specified distance, comparing beam cutoff to a reference line
- B. A digital level placed on top of each headlight assembly during inspection
- C. A measuring tape between the headlight and the ground at the front of the vehicle
- D. Visual comparison of the beam pattern against the other side's headlight beam

70. Modern LED headlight assemblies include an electronic driver module that:

- A. Generates AC current from the vehicle's DC battery for LED operation

- B. Heats the LED diodes to operating temperature during cold starts
- C. Provides protection against ultraviolet light from the LEDs during use
- D. Converts the vehicle's 12V DC into the constant current required by the LEDs

71. After replacing a power liftgate motor or strut on a vehicle, the technician must:

- A. Verify the vehicle's 12V battery is at full charge to provide accurate readings
- B. Calibrate the liftgate's open and close positions using the manufacturer's procedure
- C. Replace the BCM simultaneously to ensure compatibility with the new motor
- D. Adjust the liftgate trim panel to match the new motor's geometry exactly

72. A sunroof "one-touch" operation feature includes pinch protection that:

- A. Uses a separate dedicated pressure sensor along the sunroof seal
- B. Requires the driver to hold the switch continuously during the operation
- C. Reverses the sunroof if motor current rises sharply during the closing operation, indicating an obstruction
- D. Operates only when the vehicle is fully stationary with the parking brake on

73. Heated windshield washer nozzles are designed to:

- A. Prevent washer fluid and ice from blocking the nozzle outlet in cold weather
- B. Increase the temperature of the washer fluid for better cleaning power
- C. Spray fluid in a heated mist for fog removal during operation

D. Replace the engine coolant warming function in the washer reservoir line

74. An engine block heater (commonly used in Canadian winters) typically operates on:

- A. The vehicle's 12V battery during overnight parking automatically
- B. The vehicle's alternator output for continuous heating while driving
- C. A separate 24V auxiliary battery installed in the engine compartment
- D. 120V household AC power through a cord plugged into an outlet

75. After replacing an HVAC blend door actuator, the technician must:

- A. Drive the vehicle for at least 50 km to allow the BCM to adapt
- B. Run the manufacturer's actuator calibration procedure through the scan tool
- C. Replace the climate control head unit simultaneously with the actuator
- D. Adjust the blend door cable manually to match the new actuator position

76. On an R-134a A/C system, the high-side service port differs from the low-side port by:

- A. Color coding only — red for high side and blue for low side, with the same size
- B. The same physical fitting size but different thread direction for safety
- C. A larger diameter quick-connect fitting that prevents connecting high-pressure tools to low-side
- D. Both ports use identical fittings but are labeled "HIGH" and "LOW" only

77. Before opening an R-134a A/C system for component replacement, the technician must:

- A. Recover the refrigerant into a certified recovery machine until system pressure reaches near-zero or vacuum
- B. Vent the refrigerant slowly to atmosphere because R-134a has minimal ozone impact
- C. Heat the system to expand the refrigerant for easier recovery during the process
- D. Add additional refrigerant first to ensure adequate pressure for recovery

78. When an A/C compressor fails internally and contaminates the system, the technician should:

- A. Replace only the compressor and refill with new refrigerant after a vacuum check
- B. Add a desiccant additive to the system to absorb compressor debris during operation
- C. Flush only the evaporator because debris cannot reach the condenser side
- D. Flush with approved A/C flush and replace components that cannot be flushed (compressor, drier, orifice/TXV)

79. A leaking A/C compressor shaft seal is typically indicated by:

- A. High-pressure refrigerant spraying visibly from the compressor body during operation
- B. Oily refrigerant residue around the compressor clutch hub and pulley area
- C. A loud whining or grinding noise from the compressor during operation
- D. The compressor clutch failing to engage when commanded by the PCM

80. On a vehicle with two electric cooling fans (primary and auxiliary), the auxiliary fan typically activates when:

- A. The vehicle is parked and the engine is off
- B. The vehicle is driving above 60 km/h on the highway
- C. Coolant temperature exceeds a higher threshold than the primary fan, or A/C high-side pressure exceeds a threshold
- D. The driver presses the defrost button on the climate control panel

81. On a hybrid vehicle or modern engine with an electric water pump, the PCM:

- A. Controls coolant flow rate by varying the pump's electrical drive (often PWM), independent of engine RPM
- B. Drives the pump at the same speed as the engine through the accessory belt
- C. Activates the pump only when the engine coolant temperature exceeds 100°C during operation
- D. Operates the pump in reverse during cold starts to circulate cold coolant

82. A vehicle's engine immobilizer system prevents starting unless:

- A. The driver enters a numeric PIN code on the dashboard keypad during start
- B. The vehicle's battery is at full charge before any start attempt is made
- C. The driver is holding the brake pedal down during the start attempt
- D. The key (or fob) transponder transmits the correct security code recognized by the immobilizer module

83. After tire rotation on a vehicle with direct TPMS sensors that report by location, the technician must:

- A. Wait 30 minutes of driving for the sensors to automatically learn new positions

- B. Replace all four sensors because the original learning is permanently set
- C. Perform the manufacturer's TPMS relearn procedure (scan tool, magnet activation, or auto-learn drive cycle)
- D. Disconnect the battery for 60 minutes to clear the old TPMS data

84. A "brake hardware kit" supplied with new brake pads typically contains:

- A. New brake calipers and slide pins for complete brake replacement
- B. Anti-rattle clips, abutment shims, and caliper hardware to ensure proper pad fit and function
- C. New brake hoses and bleeder screws for hydraulic system service
- D. New brake rotors and dust shields matched to the new pad set

85. To compress a single-piston brake caliper piston during brake pad service, the technician typically uses:

- A. A C-clamp or dedicated caliper piston compression tool against the piston face
- B. Hand pressure only, by pushing the piston back into the caliper body
- C. A pry bar between the caliper and the rotor to push the piston back
- D. Compressed air introduced through the bleeder screw to push the piston out

86. Brake rotor lateral runout (side-to-side wobble) is measured with:

- A. A vernier caliper across the rotor at multiple locations around the face
- B. A micrometer measuring rotor thickness at several positions on the disc

- C. A dial indicator against the rotor face as the rotor is rotated by hand
- D. A torque wrench applied to the wheel bearing during inspection

87. Brake rotor parallelism (thickness variation) is measured with:

- A. A dial indicator clamped to the caliper bracket during rotor rotation
- B. A torque wrench checking the rotor's resistance to rotation at the hub
- C. A vernier caliper across the rotor face at multiple measurement positions
- D. A micrometer measuring rotor thickness at 6 to 8 positions equally spaced around the rotor

88. The rubber diaphragm under the master cylinder reservoir cap:

- A. Provides the primary brake fluid seal against pressure during operation
- B. Expands and contracts to maintain a sealed reservoir while allowing fluid level changes
- C. Filters debris from brake fluid entering the master cylinder reservoir
- D. Holds the reservoir cap in place during heavy braking on rough roads

89. A vehicle's "ESC off" or "Traction Control off" switch typically:

- A. Disables ABS as well as ESC for complete brake control by the driver
- B. Permanently disables ESC until the dealer re-enables it through the scan tool
- C. Reduces or disables ESC interventions for situations like deep snow or sand, with full ESC restored at next start (varies by model)
- D. Switches the brake system from hydraulic to electronic brake-by-wire mode

90. After a wheel alignment on a vehicle with electronic stability control, the steering angle sensor (SAS) often requires:

- A. A zero-point calibration using the scan tool to teach the SAS that the wheels are now centered
- B. Replacement of the entire steering column assembly to reset the sensor zero point
- C. A 30-minute drive cycle for the SAS to self-learn the new alignment automatically
- D. Manual adjustment of the SAS housing to align with the centered steering wheel

91. Positive caster on a front suspension means:

- A. The steering axis tilts inward at the top, when viewed from the front of the vehicle
- B. The wheel tilts inward at the top, when viewed from the front of the vehicle
- C. The steering axis is exactly vertical, when viewed from the side of the vehicle
- D. The steering axis tilts rearward at the top, when viewed from the side of the vehicle

92. Excessive negative camber typically wears the tire on:

- A. Both outer and inner edges simultaneously over time
- B. The center of the tread, with the edges showing little wear
- C. The inner edge (toward the vehicle centerline) of the tread
- D. The outer edge (toward the wheel well) of the tread

93. With the front wheels straight ahead and the vehicle at rest, "toe-in" means:

- A. The front of both tires points outward (away from the vehicle centerline)
- B. The front of both tires points inward (toward the vehicle centerline)
- C. The wheels are angled vertically inward at the top
- D. The wheels are at maximum angle from the steering wheel position

94. Front-axle "setback" is an alignment angle that describes:

- A. One front wheel positioned behind the other along the longitudinal axis (often from collision damage)
- B. The amount the front axle is positioned behind the front bumper centerline
- C. The vertical angle of the steering column relative to the floor
- D. The difference between the left and right caster angles on the front suspension

95. On a vehicle where the lower ball joint carries the suspension load, ball joint play is tested with:

- A. The wheel hanging freely off the ground at full extension of suspension
- B. The vehicle on the ground with the technician rocking the steering wheel
- C. The lower control arm supported by a jack stand to unload the ball joint, then prying upward on the tire
- D. The wheel removed and the ball joint disassembled from the steering knuckle

96. A suspension "bump stop" is designed to:

- A. Prevent the wheel from contacting the wheel well during heavy braking
- B. Provide the primary spring force during normal vehicle suspension travel

- C. Adjust the vehicle's ride height to match the manufacturer's specification
- D. Cushion the suspension at the end of compression travel, protecting strut and components

97. The DOT (Department of Transportation) date code on a tire's sidewall indicates:

- A. The week and year of tire manufacture (last four digits, e.g., "2823" = 28th week of 2023)
- B. The date the tire was originally sold to the first retail customer
- C. The expiration date after which the tire must be replaced
- D. The date the tire was last inspected for safety compliance

98. When replacing tires in pairs (not all four), the new tires should be installed on:

- A. The front axle to provide the best steering response on the vehicle
- B. The rear axle, regardless of whether the vehicle is FWD or RWD, for stability under wet conditions
- C. The drive axle (front on FWD, rear on RWD) for best traction
- D. The non-drive axle for even wear with the older tires

99. When cleaning aluminum alloy wheels, the technician should:

- A. Use steel wool to remove embedded brake dust completely from the surface
- B. Apply muriatic acid to dissolve corrosion and brake dust deposits
- C. Use a pH-neutral wheel cleaner formulated for the specific wheel finish
- D. Use compressed air at maximum pressure with no chemical cleaners at all

100. Modern tire mounting machines use:

- A. Manual tire irons exclusively, without any automated mounting assistance
- B. Compressed air alone to seat the tire bead onto the wheel rim
- C. A heated chamber to soften the tire rubber before installation
- D. Powered mounting and demounting heads with adjustable bead-pressing tools

101. The manufacturer's bedding-in procedure for new brake pads typically requires:

- A. Several moderate stops from highway speed, allowing the brakes to cool between each
- B. One full-pressure emergency stop from highway speed to seat the pads firmly
- C. No special procedure because modern pads bed in during normal driving
- D. The vehicle to be driven for 1,000 km without any brake application

102. Modern active wheel speed sensors typically use which type of tone ring?

- A. A toothed steel ring with mechanical teeth machined into the surface
- B. A serrated edge on the brake rotor with even spacing of teeth
- C. A magnetic encoder ring with alternating north-south magnetic poles embedded in the bearing seal
- D. An optical encoder with a printed pattern read by infrared sensors

103. Hydraulic brake lines (steel tubing) are commonly fitted with which type of flare?

- A. A 45-degree single flare for general industrial hydraulic connections
- B. A 45-degree double flare or an ISO bubble flare designed for brake applications
- C. A compression fitting with a captured ferrule on the line end
- D. A push-to-connect plastic fitting for quick installation in the field

104. Brake fluid replacement is typically recommended:

- A. Only when the brake fluid level drops below the minimum mark on the reservoir
- B. Only when the brake fluid color visibly darkens from clear to dark amber
- C. Only when the brake pads or shoes are replaced as part of brake service
- D. At a regular interval (typically every 2 to 3 years) regardless of mileage, due to moisture absorption

105. A brake caliper rebuild seal kit typically contains:

- A. The piston seal (square-cut), dust boot, bleeder screw, and slide pin boots, with the technician reusing the caliper body
- B. A complete new brake caliper assembly to replace the original entirely
- C. Only the brake pads and the slide pin bushings for the caliper
- D. The caliper bracket and mounting hardware for replacement

106. A customer complains of heavier-than-normal steering effort on a vehicle with hydraulic power steering. The first diagnostic check should be:

- A. Replace the power steering pump and pressure hose preventively

- B. Adjust the steering gear's input shaft preload to compensate for wear
- C. Verify the power steering fluid level and condition, plus drive belt tension and condition
- D. Disconnect the steering rack and inspect the inner tie rod ends for wear

MWA G: Restraint Systems, Body, and Accessories (Questions 107–116)

107. After an airbag deployment in a collision, the SRS control module (SDM):

- A. Can be reset by clearing the deployment codes with a scan tool
- B. Must be replaced with a new module, as it stores permanent deployment data and may have internal damage
- C. Will automatically clear deployment data after 30 days of continuous operation
- D. Operates normally after replacement of only the deployed airbag itself

108. Side impact airbags on most modern vehicles are most commonly located:

- A. Above the front windshield, deploying downward during a side impact event
- B. In the rear seat headrests, deploying forward during a side impact event
- C. Under the rear bumper, deploying upward during rear impact events
- D. In the front seat outboard side bolster (seat-mounted side airbag) for chest/torso protection

109. A vehicle's passenger airbag is automatically suppressed (will not deploy) when:

- A. The seat occupancy classification sensor detects an empty seat or a child weight class
- B. The driver presses an "airbag off" button on the dashboard manually
- C. The vehicle is travelling below 30 km/h when the impact occurs
- D. The passenger seat belt buckle switch is unlatched at the moment of impact

110. The SRS clock spring (in the steering column) provides:

- A. A constant rotation rate for the steering wheel during normal use
- B. The primary impact sensor for frontal collision detection at the front
- C. An electrical connection between the steering wheel-mounted controls and the vehicle's wiring harness while allowing steering wheel rotation
- D. The mechanical spring force that returns the steering wheel to center after turns

111. After replacing a power window motor on a modern vehicle, the anti-trap (pinch protection) function must be:

- A. Disabled to prevent false reverse activations during normal operation
- B. Replaced by a new sensor module mounted in the door panel assembly
- C. Adjusted manually by turning a screw on the new motor housing
- D. Initialized through the manufacturer's procedure so the BCM can re-learn the normal force profile

112. A vehicle's hood prop rod (sometimes called a hood support rod):

- A. Replaces the gas-charged hood struts when the struts fail and lose pressure

- B. Holds the hood open in a fixed position by inserting into a bracket on the engine bay
- C. Provides the primary hinge mechanism for the hood at the rear
- D. Releases the secondary safety latch from the cabin during operation

113. A power tailgate "cinch" latch (sometimes called a snug-down or pull-down latch) functions to:

- A. Pull the tailgate fully closed from a partially-closed (soft-close) position electrically
- B. Release the tailgate when the key fob button is pressed for opening
- C. Apply the parking brake automatically when the tailgate is opened during a service
- D. Provide a backup mechanical latch in case the primary latch fails completely

114. A rear hatch gas strut that no longer holds the hatch open in the up position typically:

- A. Requires recharging with compressed air through the strut's valve fitting
- B. Indicates the rear hatch needs to be aligned with the body opening for stability
- C. Has lost gas pressure internally and requires replacement with a new strut
- D. Indicates the hatch's safety latch is improperly adjusted at the body

115. A convertible top boot (or tonneau cover) is:

- A. The rubber seal between the convertible top and the windshield frame for weather protection
- B. A protective garage cover used when the vehicle is stored long-term
- C. The plastic shroud that covers the convertible top's hydraulic pump location

D. A removable fabric or vinyl cover that fits over the stowed convertible top in the well for a finished appearance

116. During body and frame repair, "control points" are:

- A. Locations on the body where the technician can apply hydraulic pressure for straightening
- B. Manufacturer-specified reference points used to measure dimensions and verify alignment after repair
- C. Switches inside the cabin that activate the body alignment electronic measurement system
- D. Hand-painted reference marks made by the technician during disassembly for reassembly

117. In a Toyota-style hybrid vehicle, the power split device is:

- A. A planetary gearset connecting the engine, motor-generator 1, and motor-generator 2, allowing flexible power distribution
- B. A continuously variable transmission with rubber belts driving the wheels
- C. A two-speed manual transmission selected by the driver
- D. A direct mechanical clutch between the engine and the drive wheels

118. One-pedal driving on an EV refers to:

- A. The combination of throttle and brake into a single pedal switch
- B. The vehicle's automatic emergency braking system at low speeds
- C. Aggressive regenerative braking that slows the vehicle significantly when the accelerator is released, often without using the brake pedal
- D. A safety feature that allows the vehicle to stop with only one functioning pedal

119. On an EV or hybrid, the 12V auxiliary battery is charged by:

- A. A small gasoline generator that runs intermittently to charge the battery
- B. The friction brakes through regenerative braking on each stop
- C. A separate 12V trickle charger plugged into a wall outlet during overnight parking
- D. The DC-DC converter, which steps down voltage from the high-voltage battery to charge the 12V battery

120. The high-voltage service plug (manual service disconnect, MSD) on an EV:

- A. Provides external charging access to the high-voltage battery from grid power
- B. Is manually removed by the technician to physically open the high-voltage circuit before service, eliminating the HV system as a hazard
- C. Connects the high-voltage battery to the 12V auxiliary battery during operation
- D. Is automatically disconnected by the BMS when a fault is detected at idle

121. An insulation resistance test on an EV's high-voltage system measures:

- A. The leakage current and resistance between the high-voltage conductors and chassis ground
- B. The internal resistance of each battery cell at the moment of measurement
- C. The continuity of the HV interlock loop (HVIL) during disconnection
- D. The capacitance of the DC bus capacitors in the inverter during operation

122. An insulation resistance tester (megger) used on a 400V EV high-voltage system typically applies a test voltage of:

- A. 12V DC, the same voltage as the vehicle's auxiliary battery
- B. 120V AC for grid-power compatibility during testing
- C. 500V or 1,000V DC, well above the system's operating voltage, to stress-test insulation
- D. The exact operating voltage of the high-voltage battery for accuracy

123. On a liquid-cooled EV high-voltage battery, the coolant used is typically:

- A. Standard engine oil drawn from the engine lubrication system supply
- B. A specific glycol-based coolant (often the same family as the engine coolant) with low electrical conductivity
- C. Pure water for maximum heat capacity and cooling efficiency
- D. Refrigerant from the A/C system circulated through the battery pack

124. The DC-DC converter on a hybrid or electric vehicle:

- A. Converts AC current from the inverter to DC current for the high-voltage battery
- B. Provides charging current to the high-voltage battery from external chargers
- C. Converts mechanical energy from regenerative braking into stored electrical energy
- D. Reduces the high-voltage battery's voltage (e.g., 400V) to 12V for charging the auxiliary battery and powering low-voltage loads

125. Level 1 charging on an EV uses:

- A. 480V three-phase AC at high current rates for commercial fleet operations

- B. 240V single-phase AC similar to a household dryer outlet for charging
- C. 120V single-phase AC from a standard household outlet at low current
- D. DC fast charging at 800V for the fastest possible charge rate

Practice Exam 7: Answer Key and Explanations

1. A — The skull-and-crossbones pictogram identifies acute toxicity (Categories 1, 2, or 3), meaning the substance can cause severe injury or death from a small single exposure by oral, dermal, or inhalation routes. Recognition is critical because exposure controls (ventilation, full PPE, restricted access) and emergency response requirements differ sharply from less-severe health hazards.

2. C — On a four-post drive-on hoist, the wheels remain on the runways even when raised, so chocks placed on both sides of one wheel prevent the vehicle from rolling along the runway. This is the recognized practice in provincial OHS guidance and hoist manufacturer instructions; chocking only at the front or rear leaves a roll path in one direction.

3. B — Environment and Climate Change Canada (or provincial equivalent) certification is legally required to handle, recover, or charge refrigerants in motor vehicle A/C systems under the Ozone-depleting Substances and Halocarbon Alternatives Regulations. Working without certification exposes the technician and shop to fines and prohibits any refrigerant service.

4. D — Asbestos fibres become airborne when dry-cleaned with brush or compressed air, posing a long-term inhalation hazard. Provincial OHS regulations require dust control through a HEPA-rated vacuum or a wet cleaning method to capture fibres before they can disperse into the shop air.

5. A — Used motor oil, brake fluid, and coolant contain chemicals (including PAHs and ethylene glycol) that can be ingested through hand-to-mouth contact. Washing hands thoroughly with soap and water before eating, drinking, or smoking is the most effective barrier between workplace chemical exposure and personal ingestion.

6. B — Vehicle exhaust contains carbon monoxide, NO_x, hydrocarbons, and other harmful gases that accumulate to dangerous levels indoors with engines running. Provincial OHS regulations require exhaust ventilation systems (tailpipe extractors or general exhaust) to keep indoor air below permissible exposure limits.

7. D — The dead tree and fish pictogram is the WHMIS 2015 environmental hazard symbol, identifying substances hazardous to the aquatic environment if released to water systems. The pictogram triggers spill containment requirements and proper disposal protocols that prevent the substance from reaching drains, sewers, or surface water.

8. C — Lead-acid batteries contain lead and sulphuric acid, both hazardous wastes regulated under provincial environmental laws. Licensed battery recycling facilities recover the lead, plastic, and electrolyte for reuse; the regulated chain of custody also typically includes a refund of the core charge to the customer.

9. B — Provincial first aid regulations specify the minimum required contents based on the shop's size, hazard level, and distance to medical care. The required kit ensures consistent emergency response capability across workplaces and is verified during workplace safety inspections.

10. A — Compression ratio equals (cylinder displacement + chamber volume) divided by chamber volume: $(500 + 50) \div 50 = 550 \div 50 = 11:1$. The chamber volume is the denominator because it represents the fully compressed gas volume at TDC, against which the swept volume is compared.

11. D — Piston-to-bore clearance is the gap between the piston skirt and the cylinder wall at the largest dimension of the piston, measured cold. Insufficient clearance causes piston scuffing as the piston expands when warm; excessive clearance causes piston slap and oil consumption.

12. C — Plastigage is a thin plastic strip placed between a bearing journal and its corresponding bearing during assembly; tightening the cap to spec crushes the strip, and the resulting width (compared to a scale) reveals the actual clearance. The technique requires no special tooling and is the standard method during engine rebuild.

13. B — Cylinder honing creates a controlled crosshatch pattern of intersecting grooves on the cylinder wall that holds oil and gives the new piston rings a microscopically rough surface to seat against. Without the crosshatch, rings polish the cylinder and fail to seal, causing low compression and oil consumption.

14. D — Crankshaft regrinding removes a small amount of journal diameter to restore a smooth, parallel bearing surface, producing an undersize journal (typically 0.010", 0.020", or 0.030" undersize). Matching undersize bearings restore the correct oil clearance against the now-smaller journal; standard bearings would create excessive clearance and low oil pressure.

15. D — Cam lift is the maximum distance the valve opens from its closed (seated) position, typically specified in millimetres or thousandths of an inch. Lift is distinct from duration (degrees of crank rotation) and from cam timing (when the valve opens relative to crank position).

16. C — Installed height is the distance from the valve spring's seated surface to the bottom of the retainer when the valve is closed. The measurement determines whether the spring is producing the correct seat pressure; if it's too tall, shims under the spring restore the specified seat load.

17. A — Solid lifters require mechanical clearance (lash) between the rocker arm and the valve stem tip to allow for thermal expansion. The measurement is taken at the specified temperature (hot or cold) with the cam lobe on its base circle for that valve, so the rocker arm is at its lowest position.

18. B — Cylinder head pressure testing pressurizes the coolant or oil passages and submerges the head in heated water (or applies dye) to find leaks. The test detects cracks, porosity, or warped sealing surfaces invisible to visual inspection but capable of causing combustion-to-coolant leaks once reassembled.

19. D — The pressure relief valve in the oil pump opens when oil pressure exceeds the calibrated limit (often 60-100 psi), returning excess oil directly to the pan. This protects the lubrication system from damage caused by excessive pressure during cold start when the oil is thick.

20. C — An engine oil cooler transfers heat from the engine oil to either the engine coolant (oil-to-coolant heat exchanger, common on cars) or directly to ambient air (oil-to-air radiator, common on trucks and performance engines). Oil temperature control prevents oxidation, viscosity breakdown, and bearing damage under high-load operation.

21. A — A coolant level sensor (typically a float or thermistor) in the surge tank or radiator illuminates a dashboard warning when fluid drops below the calibrated minimum. The warning indicates a possible leak, low fill after service, or a developing problem, prompting investigation before overheating occurs.

22. B — Cooling system pressure testing uses a hand pump with a gauge that adapts to the radiator cap opening. The system is pressurized to the cap's rated pressure (typically 15-18 psi); the gauge is then watched for a pressure drop that indicates an internal or external leak somewhere in the system.

23. D — The Schrader test port on the fuel rail is the standard connection point for fuel pressure measurement on most port-injection systems. On systems without a Schrader port, a tee fitting can be temporarily installed in the supply line. Direct connection at the rail provides an accurate reading of the pressure the injectors actually receive.

24. C — Fuel pump current draw is measured with an inductive amp clamp on the supply wire during operation. The reading is compared to the manufacturer's specification; excessive current indicates increased pump mechanical load from internal wear or restriction, while low current can indicate a partially open winding.

25. B — Modern oxygen sensors have an internal heating element that brings the sensor to operating temperature (typically 600°C or higher for zirconia sensors) within seconds of engine start. The heater enables accurate readings during the cold-start warm-up period when emissions are highest, dramatically reducing total emissions output.

26. A — An EGR cooler is a heat exchanger that cools the recirculated exhaust gas (using engine coolant) before it enters the intake manifold. Cooler EGR gas is denser, allowing more EGR mass per volume for better NO_x reduction, while preventing intake air temperatures from rising too high.

27. D — The DPFE sensor measures the pressure difference across a calibrated metering orifice in the EGR pipe; the PCM uses the pressure differential to calculate actual EGR mass flow rate. This indirect measurement is more accurate than valve position alone, especially as the EGR valve carbons up over time.

28. B — A specialized MAF sensor cleaner is formulated to evaporate without leaving residue and is safe for the delicate hot-wire or hot-film sensing element. Carburetor cleaner, brake cleaner, or solvent will damage the sensor element; compressed air can break the wire; and physical contact with the wire destroys it.

29. C — Modern GDI injector pulse widths are measured in milliseconds (typically 0.3-5 ms at idle to medium load) and vary continuously with engine load, RPM, fuel pressure, and other operating conditions. The PCM commands the precise pulse width needed for the current fuelling target on each combustion event.

30. A — A VVT oil control valve can be bench-tested by applying battery voltage across its coil terminals; a healthy solenoid produces an audible click as the spool valve shifts. The click confirms the

solenoid is mechanically free and the coil produces sufficient magnetic force, isolating the solenoid from PCM or wiring faults.

31. D — HEUI injectors (used on Ford 7.3L and 6.0L Powerstroke and some Caterpillar engines) use engine oil pressure routed through an internal pressure intensifier to amplify oil pressure into very high injection pressures (often over 20,000 psi). Common-rail systems use a dedicated high-pressure fuel pump instead, eliminating the oil-driven intensifier.

32. B — In the recessive (logic 1) state, both CAN-H and CAN-L sit at approximately 2.5V with no differential between them. When the network is at idle (no active transmission), the bus rests in the recessive state, so CAN-H to ground reads about 2.5V on a DMM.

33. C — During active CAN transmission, dominant bits drive CAN-H upward (to about 3.5V) and CAN-L downward (to about 1.5V) simultaneously from the 2.5V resting point. The differential signalling is intentional: it provides excellent noise immunity because external electrical noise affects both wires equally and cancels out at the differential receiver.

34. A — With the network unpowered, CAN-H to CAN-L resistance reflects the two 120-ohm terminating resistors connected in parallel (at the two ends of the bus). Two 120-ohm resistors in parallel produce 60 ohms ($120 \div 2$). A reading significantly different from 60 ohms indicates a missing or shorted terminator.

35. D — Modern CAN networks use either 11-bit "standard" CAN-IDs (up to 2,048 unique IDs) or 29-bit "extended" CAN-IDs (up to over 500 million unique IDs), with the choice depending on the application. Both can coexist on the same bus; the format is encoded in the message header.

36. B — When a CAN module accumulates enough transmit errors to enter "bus-off" state, it disconnects from the network until its error counters are reset. An ignition cycle (key off then on) resets the module's internal counters and typically restores normal communication if the original fault was intermittent.

37. C — Address 0x7DF in UDS/ISO 15765-4 is the standardized functional broadcast address used by generic OBD-II scan tools. Any OBD-II-compliant emissions module that supports the requested service (e.g., Mode 01 current data, Mode 03 stored DTCs) responds, allowing the scan tool to discover all available modules.

38. A — Modern modules store adaptive values, learned positions, and recent operating parameters in non-volatile memory at key-off. Sequenced load shedding gives each module time to complete these write operations before its power is removed, then transitions the network to sleep mode. Abrupt power loss can corrupt these stored values.

39. D — A reprogramming session interrupted by power loss or communication failure typically leaves the module in a partially-flashed state, often unable to boot normally. Recovery may require a special "boot mode" programming session, replacement of the module, or specialized recovery tools, depending on the module's design.

40. B — LIN operates at a maximum of 20 kbps over a single wire with ground return, using a master-slave architecture. The low speed and simple physical layer make LIN inexpensive for non-critical comfort and convenience subsystems (windows, mirrors, climate flaps, seat motors) where CAN bandwidth would be wasted.

41. C — Automotive Ethernet (IEEE 100BASE-T1 / BroadR-Reach over a single twisted pair) is replacing MOST on newer luxury vehicles for infotainment and camera data. Ethernet provides high bandwidth (100 Mbps to 10 Gbps), lower cost than MOST, and shares technology with broader internet/computing standards, simplifying development.

42. A — Mode 02 retrieves freeze frame data — the snapshot of engine operating parameters (RPM, load, fuel trim, coolant temperature, vehicle speed) captured at the moment a confirmed DTC was set. Freeze frame data is invaluable for understanding the conditions that produced the fault and for reproducing intermittent problems.

43. B — CAN-FD increases the data-phase bit rate (up to about 5 Mbps versus Classic CAN's 1 Mbps maximum) and the payload per frame (up to 64 bytes versus 8 bytes). The arbitration phase remains backward-compatible with Classic CAN, so a CAN-FD bus can be implemented progressively without replacing all modules at once.

44. D — A clutch master cylinder pushrod requires specified free play (typically 1-3 mm) between the pushrod tip and the master cylinder piston when the pedal is at rest. The free play ensures the master cylinder's compensating port is fully open at rest, allowing fluid expansion and contraction without pressurizing the slave cylinder.

45. C — GL-5 gear oils contain sulphur-phosphorus extreme-pressure additives that, at operating temperature, can chemically attack yellow metals (brass, bronze) used in some synchronizer components. Manual transmissions specifying GL-4 or synchromesh-specific fluid require these less aggressive formulations to protect the synchronizer rings.

46. A — Synchromesh fluids are formulated with specific friction modifiers and viscosity characteristics that allow synchronizer cones to grip properly during shifting, producing the smooth synchronizing action drivers expect. Using a generic gear oil can cause hard shifting, grinding, or accelerated synchronizer wear.

47. A — A conventional automatic transmission filter is mounted inside the transmission and accessed by removing the transmission oil pan. After cleaning the pan and replacing the filter, a new pan gasket is installed during reassembly. The procedure also exposes the magnet (if present) and provides an opportunity to inspect for debris.

48. B — Automatic transmission cooler lines are steel tubes (not rubber, due to ATF temperature and pressure) with either flared fittings or quick-connect fittings at the radiator and transmission ends. The steel construction provides durability and is required for safety as the lines carry hot ATF under pressure.

49. C — Differential side bearing (carrier) preload is set either by selective shims placed behind each bearing cup, or by threaded adjusters that screw the bearing cups inward (often called "ringless" or "threaded adjuster" axles). Both methods preload the bearings to specification, eliminating endplay while preventing over-tightening.

50. A — Pinion depth (how deep the pinion gear meshes with the ring gear) is verified by painting the ring gear teeth with marking compound, rotating the gears, and inspecting the contact pattern. The pattern's position on the tooth (toe, heel, flank, face) indicates whether pinion depth needs adjustment with shims.

51. D — Ring gear runout is measured with a dial indicator positioned against the ring gear's back (flat) face as the gear is rotated one full revolution. Excessive runout indicates a bent ring gear, debris between the gear and the carrier, or a damaged carrier flange. The reading must be within manufacturer's specification.

52. B — A Rzeppa CV joint is disassembled by removing the inner snap ring, sliding the joint off the axle splines, then tilting the cage so the balls can be removed one at a time through the cage openings. Reassembly reverses the sequence with new grease throughout.

53. A — The axle nut on a FWD half-shaft is highly torqued and is loosened with the vehicle on the ground so the wheel's weight and traction prevent rotation. Attempting to loosen the nut with the vehicle lifted causes the axle to spin freely, making removal extremely difficult and dangerous.

54. C — During U-joint installation, the press must contact only the outer surface of the bearing cup, transferring force through the cup into the yoke. Pressing on the center cross damages the needle bearings; pressing on the bearings directly destroys them. A proper U-joint press has a driver that matches the cup outer diameter.

55. D — Transfer case low range gearing is most commonly achieved by a planetary gearset that provides a reduction (typically 2:1 to 2.7:1) when engaged. The planet carrier is grounded to the housing in low range, multiplying input torque by the reduction ratio and slowing output speed proportionally.

56. B — A viscous coupling engages passively through shear of silicone fluid as wheel speed differential develops, requiring no electronic control. A Haldex coupling uses a wet multi-plate clutch pack engaged by an electrohydraulic pump under ECU control, providing predictive, variable, fast-acting AWD engagement.

57. A — Reactive AWD systems compare front and rear wheel speeds (using ABS sensor data) and begin engaging the rear coupling when the speed differential exceeds a calibrated slip threshold. The system reacts to actual slip; predictive AWD systems instead engage based on throttle, steering, and other inputs before slip develops.

58. C — Differential refill requires the manufacturer-specified gear oil type, viscosity, and the correct volume (typically 1.5-2.5 L depending on axle size). Specifications also indicate whether friction modifier is needed for limited-slip differentials. Under-filling causes overheating; over-filling causes seal damage.

59. D — Before removing the pinion nut for seal replacement, the technician marks the nut and shaft position with a paint pen or punch mark. Reinstalling the nut to the marked position approximates the original bearing preload, avoiding a full preload setup procedure when only the seal is being replaced.

60. B — A failed clutch master cylinder seal allows hydraulic fluid to bypass internally past the piston cup back into the reservoir. The pedal sinks under steady pressure with no visible external leak because the fluid never leaves the master cylinder. Replacement of the master cylinder is the repair.

61. A — Watt's Law states $P = V \times I$, so a 12 V circuit drawing 5 amps consumes $12 \times 5 = 60$ watts. The relationship lets the technician calculate power for any circuit element when voltage and current are known, useful for sizing wire, fuses, and load capacity.

62. D — Series resistance equals the simple sum of all resistor values: $2 + 3 + 5 = 10$ ohms. In a series circuit, current flows through each resistor sequentially, so each resistor adds its full resistance to the path. Voltage drops across each resistor in proportion to its resistance.

63. C — Two equal resistors in parallel produce a total resistance equal to half of either resistor's value, so two 10-ohm resistors in parallel give 5 ohms. The parallel formula ($1/R_{\text{total}} = 1/R_1 + 1/R_2$) confirms this; with equal values it simplifies to $R/2$.

64. B — A Hall-effect crankshaft sensor produces a digital square-wave signal at a frequency proportional to engine speed, so the DMM should be set to its frequency (Hz) measurement scale. The reading varies with cranking and running speed; DC voltage or resistance scales cannot quantify the changing pulse rate.

65. A — Duty cycle equals the on-time divided by the total cycle time, expressed as a percentage. With 4 ms ON during each 20 ms cycle: $4 \div 20 = 0.20 = 20\%$. Duty cycle measurement is critical for understanding PWM-controlled actuators like fuel injectors, idle air controls, and solenoids.

66. D — HV insulating gloves must be visually inspected for cuts, cracks, or contamination before each use, then air-tested (the technician rolls the cuff to inflate the glove and listens for leaks). Periodic recertification by a qualified test laboratory is required, typically every 6 months for Class 0 (1,000V rated) gloves.

67. C — State of health (SOH) measures the battery's remaining capacity compared to its original new capacity, expressed as a percentage (a battery at 80% SOH has lost 20% of its original capacity). SOH is distinct from state of charge (SOC), which is how full the battery is at the moment. SOH degrades over time and use.

68. B — A smart charger detects battery state and adjusts charging through programmed stages: bulk charge (high current to about 80%), absorption (constant voltage with declining current), and float (low maintenance current). The staged approach maximizes life and avoids overcharging that a basic trickle charger could produce.

69. A — Headlamp vertical aim is verified using either a dedicated headlight aimer or a measured wall pattern at a specified distance (typically 25 feet). The technique compares the actual beam cutoff position to a reference line representing the target aim. Provincial inspections check headlamp aim against these standards.

70. D — LED headlamps require a constant current source for the diodes; supplying the raw 12V vehicle voltage would burn out the LEDs immediately. The electronic driver module (LED ballast) converts the vehicle's nominally 12V DC into the constant current (typically 350-1,500 mA) the LED array requires.

71. B — A new liftgate motor or strut requires calibration of the open and close limits so the BCM knows the correct travel range. The manufacturer's procedure (typically a manual cycle through full travel with specific timing) teaches these limits; without calibration, the liftgate may over-travel, under-travel, or generate fault codes.

72. C — A sunroof one-touch pinch protection function reverses the sunroof if motor current rises sharply during closing, indicating an obstruction. The BCM monitors motor current and Hall pulse rate to detect normal versus abnormal resistance; abnormal resistance triggers immediate reversal to prevent injury.

73. A — Heated windshield washer nozzles use a small electric heating element around the nozzle to prevent washer fluid from freezing in the nozzle and to thaw ice that might block the spray. Common on vehicles sold in cold climates, the nozzles are typically activated whenever the rear defroster is on or by ambient temperature.

74. D — Engine block heaters use a resistive heating element installed in a coolant passage, powered by 120V household AC through a cord plugged into a standard outlet. The heater warms the coolant overnight, easing cold-weather starting, reducing engine wear during warm-up, and reducing emissions immediately after start.

75. B — After replacing an HVAC blend door actuator, the manufacturer's calibration procedure must be run through the scan tool. The procedure teaches the new actuator its travel limits and zero position, ensuring the door opens fully from cold to hot positions and providing correct temperature blending response.

76. C — On an R-134a A/C system, the high-side service port has a larger diameter quick-connect fitting than the low-side port. The size difference physically prevents accidental connection of low-side equipment to the high-pressure side and vice versa, protecting the technician and the equipment.

77. A — Before opening any A/C system for component replacement, the refrigerant must be recovered into a certified recovery machine (per provincial environmental regulations) until system pressure reaches near-zero or vacuum. Venting R-134a to atmosphere is prohibited and carries fines. Recovery captures the refrigerant for reuse or proper disposal.

78. D — Internal compressor failure contaminates the entire A/C system with metal debris. The technician must flush the system with approved A/C flush (or replace the components that hold debris). Components that cannot be flushed (the new compressor, the accumulator or drier, and the orifice tube or TXV) must be replaced.

79. B — A leaking A/C compressor shaft seal lets refrigerant carrying oil escape past the seal, depositing oily residue on the compressor clutch hub, pulley, and surrounding area. The visible oil identifies the leak location even when refrigerant has fully escaped. Replacement of the compressor (or the seal kit on rebuildable designs) is the repair.

80. C — On a vehicle with two electric cooling fans, the auxiliary fan typically activates when either coolant temperature exceeds a higher threshold than the primary fan (e.g., 100°C versus 92°C) or A/C high-side pressure exceeds a threshold. The dual-stage operation provides additional cooling capacity only when needed.

81. A — Modern electric water pumps are PWM-controlled by the PCM, varying coolant flow rate independently of engine RPM. The arrangement allows reduced flow during warm-up (for fast cabin heat) and increased flow during heavy load, improving fuel economy and providing precise thermal management.

82. D — A vehicle's engine immobilizer system requires the correct security code transmitted from the key (or fob) transponder via short-range RFID to the immobilizer module. Without the matching code,

the immobilizer module prevents the PCM from operating the fuel injectors or ignition, blocking engine start.

83. C — After tire rotation on a vehicle with location-reporting TPMS, the manufacturer's relearn procedure is required to teach the BCM which sensor is at which corner. The procedure varies by manufacturer: scan tool commands, magnetic activation tool at each wheel, or an auto-learn drive cycle at specified speed.

84. B — A brake hardware kit supplied with new brake pads contains anti-rattle clips, abutment shims, caliper hardware, and sometimes new caliper pins or pad retention springs. These components ensure correct pad fit, prevent noise, and provide proper spring tension; reusing worn hardware causes squeal and uneven pad wear.

85. A — A C-clamp or dedicated piston compression tool is applied to the brake pad and the piston face, gradually retracting the piston into the caliper bore for new pad clearance. The slow, even pressure prevents seal damage; hand pressure typically cannot generate enough force, and using pry bars risks rotor or piston damage.

86. C — Brake rotor lateral runout (the side-to-side wobble at the friction surface) is measured with a dial indicator clamped to a fixed reference, with the probe against the rotor face as the rotor is rotated by hand. Excessive runout (typically over 0.05 mm) causes brake pulsation and accelerated pad wear.

87. D — Brake rotor parallelism (thickness variation around the rotor) is measured with a micrometer at 6 to 8 equally-spaced points around the rotor at the same radius from the center. Even a small thickness variation (over 0.025 mm typically) produces brake pedal pulsation under steady braking.

88. B — The rubber diaphragm under the master cylinder reservoir cap expands and contracts as the fluid level drops (during pad wear) and rises (during refills). The flexible diaphragm maintains a sealed reservoir, preventing moisture and contaminants from entering while accommodating fluid level changes without venting to atmosphere.

89. C — A vehicle's ESC off or Traction Control off switch typically reduces or disables ESC interventions in low-traction situations like deep snow or sand, where wheel slip is necessary for the vehicle to move. The system usually restores full ESC at the next ignition cycle to prevent the disable from being forgotten.

90. A — After a wheel alignment, the steering angle sensor (SAS) often requires a zero-point calibration using the scan tool to teach the SAS that the wheels are now centered. Without calibration, the SAS reports an incorrect steering position to the ESC and EPS modules, causing potential intervention errors.

91. D — Positive caster means the steering axis tilts rearward at the top when viewed from the side of the vehicle. This rearward tilt provides directional stability and steering return-to-center force after a turn. Most modern vehicles use 3 to 7 degrees of positive caster on the front wheels.

92. C — Excessive negative camber (wheel top tilting inward) concentrates contact pressure on the inner edge of the tire tread, producing wear on the inside edge. Diagnosis includes checking for sagging springs, worn ball joints, or collision damage that may have changed the camber from its specified value.

93. B — Toe-in means the fronts of both front tires point inward (toward each other and toward the vehicle centerline) when the steering is centered. A small amount of toe-in is normal on most RWD vehicles to compensate for driving forces that push the wheels apart; FWD vehicles often spec toe-out or near-zero toe.

94. A — Setback is an alignment angle that describes one front wheel positioned behind the other along the longitudinal axis, often the result of collision damage that displaced one wheel rearward. Significant setback indicates frame or unibody damage that may require body repair before alignment is finalized.

95. C — On a load-carrying lower ball joint, the joint must be unloaded for accurate play measurement. Supporting the lower control arm with a jack stand removes the suspension weight from the joint, then prying upward on the tire reveals any internal play. Testing without unloading produces false-pass readings.

96. D — A suspension bump stop is a hard rubber or polyurethane pad located on the strut shaft or frame that cushions the suspension at the end of compression travel. It prevents metal-to-metal contact between the strut piston and housing during severe bumps, protecting the strut and other suspension components.

97. A — The DOT date code on a tire's sidewall is the last four digits of the DOT identification number. The first two digits indicate the week of manufacture (01-52) and the last two digits the year ("2823" = 28th week of 2023). Tires older than approximately 6-10 years are generally recommended for replacement even if tread depth is acceptable.

98. B — When replacing tires in pairs, the new tires go on the rear axle regardless of which wheels drive the vehicle. New tires on the rear provide better wet-weather grip there, reducing oversteer risk during emergency maneuvers; older tires on the front retain steering response with less consequence in a slip.

99. C — Aluminum alloy wheels require a pH-neutral wheel cleaner formulated for the specific finish (clear-coated, polished, chrome-plated, or machined). Acidic cleaners (including muriatic and many bargain cleaners) etch the finish; abrasive materials like steel wool scratch the surface and accelerate corrosion.

100. D — Modern tire mounting machines use powered mounting and demounting heads, automatic bead-pressing arms, and adjustable wheel clamps that accommodate various rim sizes and TPMS-equipped wheels. The powered components reduce technician effort and the risk of wheel damage compared to manual tire iron methods.

101. A — The manufacturer's brake pad bedding procedure typically involves several moderate stops from highway speed (e.g., from 90 km/h to 30 km/h), allowing the brakes to cool between each stop. The controlled friction transfers a thin layer of pad material onto the rotor, establishing the friction couple that produces consistent stopping power.

102. C — Modern active wheel speed sensors use a magnetic encoder ring with alternating north-south magnetic poles embedded in the wheel bearing seal. The sensor reads the magnetic transitions as the bearing rotates, providing accurate wheel speed at very low speeds (including zero), which passive sensors cannot do.

103. B — Hydraulic brake lines (steel tubing) use either the 45-degree double flare (common in older North American vehicles) or the ISO bubble flare (common in modern import-influenced designs). Both are designed specifically for brake hydraulic pressures and chemistry; single flares and compression fittings are not acceptable for brake applications.

104. D — Brake fluid is hygroscopic, absorbing moisture from air through the master cylinder reservoir and through microscopic permeation in the hoses over time. Most manufacturers specify replacement every 2 to 3 years regardless of mileage to maintain the fluid's boiling point above the threshold for safe brake operation.

105. A — A brake caliper rebuild seal kit contains the square-cut piston seal, dust boot, bleeder screw, and slide pin boots needed to restore the caliper. The technician retains and reuses the caliper body and

pistons (after inspection and cleaning), making rebuild much less expensive than complete caliper replacement.

106. C — Before condemning the power steering pump or rack on a heavy-steering complaint, the technician verifies the power steering fluid level and condition, plus drive belt tension and condition. Low fluid, contaminated fluid, or a slipping belt are common, inexpensive causes that mimic more serious problems.

107. B — After airbag deployment, the SRS control module (SDM) stores permanent deployment data, may have internal damage from the crash forces, and on many vehicles has expended internal components or codes that cannot be cleared. The manufacturer's procedure requires SDM replacement after deployment, not just code clearing.

108. D — Side impact airbags on most modern vehicles are seat-mounted in the outboard side bolster, deploying from the side of the seat to cushion the occupant's chest and torso between the door and the seat. The seat-mounted location places the airbag closer to the occupant for fast, effective coverage during a side impact.

109. A — The passenger airbag is automatically suppressed by the seat occupancy classification system when the seat is empty or holds a child or child seat. The classification sensor distinguishes occupant weight categories, and the SDM applies different deployment strategies (or full suppression) accordingly.

110. C — The SRS clock spring is a coiled flat ribbon cable inside the steering column that maintains the electrical connection between the steering wheel-mounted controls (airbag, horn, audio, cruise) and the vehicle's wiring harness while allowing the steering wheel to rotate. A broken clock spring causes loss of these functions and an SRS DTC.

111. D — After replacing a power window motor, the anti-trap (pinch protection) function must be initialized through the manufacturer's procedure, typically by cycling the window through its full travel several times with specific timing. The procedure teaches the BCM the normal motor current profile so it can detect abnormal resistance from an obstruction.

112. B — A hood prop rod is a removable metal rod that holds the hood open in a fixed position by inserting one end into a bracket on the hood and the other end into a bracket in the engine bay. Prop rods are common on lighter vehicles where gas struts are not used or have failed.

113. A — A power tailgate cinch latch (sometimes called soft-close or pull-down latch) electrically pulls the tailgate from a partially-closed position to fully closed. The feature lets the user close the tailgate with light force; the cinch motor finishes the closure quietly and ensures full latch engagement.

114. C — A rear hatch gas strut that no longer holds the hatch open has lost gas pressure internally and cannot be recharged in the field. Replacement with a new strut is the standard repair. Strut failure is typical at higher mileage and is accelerated by extreme temperatures and use.

115. D — A convertible top boot (or tonneau cover) is a removable fabric or vinyl cover that fits over the stowed convertible top in the well behind the rear seats. The boot provides a finished appearance with the top down, hiding the folded top mechanism and protecting it from sun exposure.

116. B — During body and frame repair, control points are manufacturer-specified reference points on the frame or body (typically mounting holes, suspension pivot points, or factory-defined locations) used to measure dimensions and verify alignment after repair. Modern frame measuring systems compare the actual control points against the factory specifications to confirm the structure is correctly straightened.

117. A — The Toyota power split device is a planetary gearset where the engine drives the planet carrier, motor-generator 1 (MG1) connects to the sun gear, and motor-generator 2 (MG2) connects to the ring gear (which drives the wheels). The arrangement allows flexible power flow: engine to wheels, engine to battery via MG1, or battery to wheels via MG2.

118. C — One-pedal driving uses aggressive regenerative braking when the accelerator pedal is released, slowing the vehicle significantly without using the brake pedal. The driver controls speed primarily by modulating accelerator pressure, and the friction brakes engage only for hard stops or for the final stop to zero on some implementations.

119. D — The 12V auxiliary battery on an EV or hybrid is charged by the DC-DC converter, which steps down voltage from the high-voltage battery (typically 200-800V) to about 14V for charging the 12V battery and powering 12V loads. The DC-DC converter runs whenever the vehicle is on, eliminating the alternator's role.

120. B — The manual service disconnect (MSD) on an EV is a high-voltage connector at the battery pack that the technician physically removes to open the high-voltage circuit before service. Removing the MSD eliminates the HV system as an electrical hazard, supplementing the contactors that normally open at shutdown.

121. A — An insulation resistance test measures the leakage current (and corresponding resistance) between the high-voltage conductors and the chassis ground. The reading verifies that the HV system's insulation is intact, preventing the chassis from becoming energized through a fault. Modern EVs monitor this continuously through the BMS.

122. C — A megohmmeter (megger) used on a 400V EV system typically applies a test voltage of 500V or 1,000V DC, well above the system's operating voltage, to stress-test the insulation. The high test voltage reveals weaknesses that lower test voltages would miss. Modern automotive insulation testers select the appropriate test voltage based on the system rated voltage.

123. B — Liquid-cooled EV battery packs use a glycol-based coolant (often the same chemistry family as engine coolant) formulated to have low electrical conductivity. Low conductivity is essential because the coolant flows close to high-voltage components; conductive coolant would create a shock and short-circuit hazard.

124. D — The DC-DC converter on a hybrid or electric vehicle steps down the high-voltage battery voltage (typically 200-800V) to about 14V for charging the auxiliary 12V battery and powering all the conventional 12V loads (lights, infotainment, modules). The DC-DC converter replaces the alternator's function in conventional vehicles.

125. C — Level 1 EV charging uses 120V single-phase AC from a standard household outlet at low current (typically 12 amps). The slow charge rate (typically 5-8 km of range per hour) makes Level 1 suitable for overnight charging of plug-in hybrids or as an emergency option for full EVs. No special wiring is required.