Battery System

1. Hybrid electric vehicle manufacturers specify that high voltage (HV) protective gloves be worn that meet what specification?

a. SAE J1930

b. UL 1140-A

c. ANSI class "0"

d. OSHA Standard 1000

2. What rating should a DMM have to be safely used on a hybrid electric or electric vehicle?

a. CAT III

b. SAE J1930

c. 10 megohm

d. UL 1100

3. Using a scan tool, what PID indicates that a high-voltage battery pack is degraded?

a. Internal resistance

b. State of charge (SOC)

c. Battery block voltage

d. All of the above

4. At what state of charge does the ICE start to charge the HV battery on most hybrid electric vehicles (HEVs)?

a. 30%

b. 40%

c. 50%

d. 60%

5. When diagnosing high-voltage (HV) battery pack concerns, what scan tool data is one of the first to check?

a. State of charge (SOC)

b. Internal resistance

c. External resistance

d. Electrolyte level

6. What tool or type of meter should be used to check for voltage leaks/loss of isolation?

a. A CAT III DMM

b. An insulation tester

c. An ohmmeter

d. A high impedance voltmeter

7. A HV battery pack has been removed from the vehicle. The connecting straps (connectors) for some of the modules are found to be corroded. Technician A says that the connectors should be replaced. Technician B says that the battery modules should all be checked for state of charge to see that they are all within specifications. Which technician is correct?

a. Technician A only

b. Technician B only

c. Both Technicians A and B

d. Neither Technician A nor B

8. High-voltage (HV) battery packs are cooled using _____

a. A separate cooling system with the coolant circulated

by an electric-operated pump

b. Cabin or outside airflow moved by an electric blower

c. The ICE cooling system to circulate coolant around the HV battery module assembly

d. Either a or b

9. If the HV battery pack becomes degraded, what symptom may the driver experience?

a. A warning light on the dash

b. Reduced fuel economy

c. The ICE runs all or most of the time

d. Any or all of the above

10. The internal resistance of a hybrid electric vehicle is being checked using a scan tool. What is normal internal resistance?

a. 15 to 40 milliohms

b. 1.5 to 5.0 ohms

c. 3 to 7 ohms

d. 10 to 15 ohms

11. A HV battery pack is being diagnosed using a scan tool. A diagnostic trouble code can be set if there is _____ or more difference in voltage between battery blocks.

a. 2.2

b. 1.2

c. 0.3

d. 0.1

Internal Combustion Engine

12. How is the idle stop function disabled to allow the ICE to run at all times?

a. Push a button on the dash on most HEVs

b. follow a prescribed procedure

c. Turn on the heater

d. Open all doors

13. The viscosity of engine oil specified for use in a HEV is usually SAE _____.

a. 0W-20

b. 0W-30

c. 5W-30

d. 10W-40

14. If the torque displayed on a scan tool indicates that the motor/generator that is attached to the ICE is showing "positive torque." This means that the _____.

a. ICE is being driven by the motor/generator (crank mode)

b. ICE is powering the motor/generator (run mode)

c. Motor generator is charging the HV battery

d. Motor/generator is supplying electrical energy to the traction motor

15. The ICE does not start (nothing happens when the starting button or ignition key is engaged). What is the most likely cause?

a. The ICE fuel tank is empty

b. The auxiliary 12-volt battery is discharged or defective

c. The electric fuel pump for the ICE is defective

d. The HV battery pack is discharged below 50% SOC

16. A scan tool is needed to _____.

a. Check the SOC of the auxiliary 12-volt battery

b. Check the oil level in the ICE

c. Crank the engine at normal cranking speed to perform a compression test

d. All of the above

17. The ICE cooling system uses _____.

a. The same coolant as used in liquid cooled electronic cooling system

b. Pure (100%) antifreeze to provide long-term corrosion resistance

c. An ICE or electric-powered water pump

d. Both a and c

Drive Systems

18. What is needed to safely remove and/or install a permanent magnet rotor?

a. HV gloves

b. A special holder/installer

c. Insulated tools (wrenches and pliers)

d. All of the above

19. Hybrid electric vehicle (HEV) diagnostic trouble codes _____.

a. Are global (generic) codes only (P0XXX)

b. Can include letters such as P0A30

c. Often can pin down the fault

d. Both b and c

20. An insulation (isolation) tester applies _____ to test for continuity between the high-voltage cable and the chassis ground.

a. A high voltage pulse

b. A high amperage current supplied at 12 volts

c. A resistance between the two components being tested

d. A low voltage (about 2 volts) and a low current (about 0.5 A)

21. What data would be an indication of where a noise or shudder from the drivetrain may be located?

a. A low HV battery SOC

b. An auxiliary battery fault code

c. An insulation/isolation fault DTC for the traction motor

d. A fault code (DTC) for a failed resolver

22. If there is a stored diagnostic trouble code (DTC) for a loss of insulation, where should the technician first check?

a. At the HV disconnect plug

b. At the location stated in the DTC description

c. At the closest location to the chassis ground connection

d. At the closest location to the HV battery

23. What type of lubricant is used in most HEV transmissions?

a. POE dielectric fluid

b. Usually ATF of the specified type

c. POA engine oil

d. Silicone grease

24. A diagnostic trouble code (DTC) has been set for motor-rotor position sensor (resolver) fault. Technician A says that this part is a replaceable part if defective. Technician B says that it is part of the traction motor assembly and is replaced as an assembly. Which technician is correct?

a. Technician A only

b. Technician B only

c. Both Technicians A and B

d. Neither Technician A nor B

25. A cover is being removed from a HV component such as the inverter/converter. What is the purpose of the two-wire connector that is disconnected in order to remove the cover?

a. It is used to set a diagnostic trouble code if the cover is removed

b. Used to shut off the HV system and discharge the capacitors to avoid personal injury

c. Used to trigger the dash warning lamp for overheat of the inverter/converter

d. Used a ground connection so the cover is properly grounded

26. The parking pawl on most hybrid electric vehicles (HEVs) _____.

a. Is mechanically applied using a cable

b. Is not used but instead uses an electromagnet to keep the vehicle from rolling when parked

c. Uses an electric motor to move the parking pawl into position

d. Uses the traction motor to keep the vehicle from moving when parked

Power Electronics

27. The internal resistance of the HV battery modules _____.

a. Can be determined by using a scan tool

b. Can be measured using an ohmmeter after removing the modules from the battery pack

c. Has to be determined using a special high-voltage tester

d. Can be calculated from using the current draw of the traction motor and the HV battery SOC

28. The ICE does not stop running when warm and at idle speed. What could be the cause?

a. Any problem with the ICE MAF sensor

b. A low SOC of the HV voltage battery

c. A fault with the HV battery

d. Either b or c

29. When working on a hybrid electric vehicle (HEV), what type of meter leads should be used with the DMM?

a. Leads with alligator clips

b. CAT III rate leads

c. DOT-approved leads

d. SAE-approved leads

30. A factory-level aftermarket scan tool was used to retrieve two diagnostic trouble codes (DTCs). There were a P0A80 and P3006. These codes mean _____

a. The P0A30 is a false code because it has a letter instead of all numbers

b. The P3006 is a factory DTC

c. Both codes could be retrieved using a global (generic) scan tool (code reader)

d. The P0A30 is a factory code

31. The master warning lamp on the dash is on. There are many DTCs set and the driver stated that the vehicle was run out of gas when the warning light came on. What is the best approach to fix this problem?

a. Preform a circuit check of the high-voltage system checking for loss of insulation

b. Disconnect the HV battery service plug and check the system for damage related to the HV system and electronic drive system

c. Clear the codes and verify that they do not return

d. Check the ICE fluids and restore to proper level

32. Before disconnecting the high-voltage service plug, what should be done?

a. Wear HV gloves

b. Disconnect the 12-volt auxiliary battery or specified fuse/relay

c. Check service information to determine how to gain access to the high-voltage plug

d. All of the above

33. The start button is pushed and the dash lights up but the vehicle does not move and the ready to move light is not on. What is the most likely cause?

a. A weak (low charge) 12-volt auxiliary battery

b. The driver did not depress the brake pedal and the system is in the accessory mode

c. A discharge HV battery pack

d. A fault with the ignition on switch

d. Silicone grease

34. What is used to conduct heat from the inverter–converter to the area where the coolant flows?

a. Heat conductive grease

b. Engine oil

c. ATF

d. Silicone grease

35. A hybrid electric vehicle (HEV) has been in an accident. The service technician wants to check to make sure that the high voltage (HV) cables have not been hurt or have lost their electrical isolation (insulation). How is this test performed?

a. Disconnect both cables at both ends and measure the resistance between the two cables. It should be more than 10k ohms

b. Remove the service plug and allow the capacitors to discharge and then measure the voltage between the two terminals

c. After removing the HV cable from the vehicle, measure the resistance and they should be less than 0.1 ohm per foot of length

d. Use an insulator tester and after disconnecting the high-voltage cable, connect one tester lead to the terminal of the cable and the other to a good chassis ground. The results should be greater than one million ohms

36. The 12-volt auxiliary battery has been charged and even replaced several times due to low charge. The voltage of the battery as shown on a scan tool display and a DMM shows 11.2 volts. What is the most likely cause?

a. A too small auxiliary battery

b. A defective DC/DC converter

c. A defective alternator

d. A defective inverter

37. Where are the high-voltage capacitors located?

a. Under the HV battery pack on most HEVs

b. Inside the inverter/converter compartment

c. Usually attached to the ICE and they share the ICE cooling system

d. Under the vehicle between the HV battery and the ICE

38. The AC/DC inverter cooling pump is being replaced because it stopped functioning. What type of coolant should be used when refilling the system?

a. Premixed universal coolant only

b. The coolant that is recommended

c. Blue coolant that has a dielectric additive included

d. Any of the above

39. The system main relays (SMR) may trip and disable the vehicle if what occurs?

a. An airbag deploys

b. The vehicle is submerged in water

c. The system detects a fault in the insulation (isolation) between the HV system and the chassis ground

d. Any of the above

Hybrid Supporting Systems

40. How should HV gloves be tested before each use?

a. Visual inspection for any tears or openings

b. Roll the glove up to trap air and see if the air leaks

c. Use a voltmeter and check the resistance of the rubber (should be greater than 10k ohms)

d. Both a and b

41. The owner complained that while driving on a mountainous area, the HV battery display read at the top of the scale. About the same time, the brake pedal became harder to depress and more force was required to slow the vehicle. What is the most likely cause?

a. Normal operation

b. A fault with the master cylinder

c. A high-voltage battery SOC fault that caused the regenerative braking system to default to normal hydraulic brakes

d. Driver error

42. Before the brakes are serviced on many hybrid electric vehicles, what precaution(s) are often needed to be performed?

a. The brake hydraulic system needs to be placed in service mode

b. The brake pedal needs to be depressed at least 30 times to discharge the accumulator

c. The high-voltage (HV) served plug should be removed and placed in a safe location away from the vehicle

d. All of the above

43. Many hybrid electric vehicle diagnostic trouble codes also include "subcodes." What is the purpose of the subcodes?

a. They help the service technician pin down the location of the fault

b. They are used only for engineers and not to be used by a service technician

c. They list the voltage of the HV battery when the fault occurred

d. They refer to the area in service information where the details of the system are explained

44. The wiring to the electric power steering has yellow conduit which indicates _____

a. Dangerous high voltage (lower than orange cable but still fatal)

b. 12-volt circuit

c. 42-volt circuit

d. 60-volt circuit

45. The A/C compressor on a hybrid electric vehicle has failed and has to be replaced. What precautions are needed to be taken?

a. Use PAG refrigerant oil

b. Use the specified nonelectrical conductive refrigerant oil

c. Replace the HV cable to the compressor

d. Use a high-volume vacuum pump during the evacuation process.

Answer Key

1. c	13. a	25. b	37. b
2. a	14. a	26. c	38. b
3. d	15. b	27. a	39. d
4. c	16. c	28. d	40. d
5. a	17. a	29. b	41. a
6. b	18. b	30. b	42. a
7. c	19. d	31. c	43. a
8. d	20. a	32. d	44. c
9. d	21. c	33. b	45. b
10. a	22. b	34. a	
11. c	23. b	35. d	
12. b	24. a	36. b	