



## Automotive Advanced Engine Performance Specialist (L1)

Answers to these questions are found beginning on page 4 of this document

1. A port fuel-injected OBD-I equipped V-6 engine with a MAF sensor has a rough idle and no diagnostic trouble codes (DTCs). Technician A says that the wrong PCV valve could have been installed during a previous service. Technician B says that a missing oil filler cap could be the cause. Which technician is correct?
  - a. Technician A only
  - b. Technician B only
  - c. Both Technicians A and B
  - d. Neither Technician A nor B
  
2. Service information is available from all of the following *except* the \_\_\_\_\_.
  - a. Service manual
  - b. Owner's manual
  - c. Electronic service information CDs
  - d. Factory Web sites
  
3. A P0300 (random misfire) DTC is being diagnosed. What service information is needed to be able to perform an effective diagnosis?
  - a. Spark plug wire resistance specifications
  - b. VIN
  - c. Engine code
  - d. All of the above
  
4. Which of the following data stream information is the *least likely* to be helpful during the diagnosis of a hard starting problem?
  - a. O2S
  - b. ECT
  - c. CMP
  - d. CKP

5. A DTC P0326 (knock sensor circuit range or performance) is being diagnosed. Technician A says that an engine mechanical fault such as a loose crankshaft harmonic balancer pulley could be the cause. Technician B says that an excessively lean air/fuel mixture could cause excessive knock sensor activity. Which technician is correct?
- Technician A only
  - Technician B only
  - Both Technicians A and B
  - Neither Technician A nor B
6. A vehicle is being diagnosed that overheats only during city-type driving, yet does not overheat if driven at highway speeds. Technician A says that an inoperative electric cooling fan may be the cause. Technician B says that a partially clogged radiator is the most likely cause. Which technician is correct?
- Technician A only
  - Technician B only
  - Both Technicians A and B
  - Neither Technician A nor B
7. The coolant temperature gauge on a rear-wheel-drive vehicle indicates that the engine is running hotter than normal, but only after it has been driven at highway speeds for several miles (km). The temperature gauge indicates normal coolant temperature when the vehicle is driven at lower speeds such as in city traffic. Which is the *least likely* cause?
- Defective fan clutch
  - Restricted radiator
  - Low coolant level
  - Worn water pump impellers
8. An engine overheats and loses coolant, yet there is no evidence of an external leak. Technician A says that the cooling system should be pressure tested to help find the cause of the coolant loss. Technician B says that a 4- or 5-gas exhaust analyzer can be used to read the hydrocarbons (HC) coming from the radiator fill opening with the engine running to determine whether the head gasket is defective. Which technician is correct?
- Technician A only
  - Technician B only
  - Both Technicians A and B
  - Neither Technician A nor B
9. A vehicle failed a loaded I/M emission test for excessive NO<sub>x</sub> and experiences spark knock (also called ping or detonation) during acceleration. Which is the *least likely* cause?
- Partially clogged radiator
  - Lean air/fuel mixture
  - Partially clogged catalytic converter
  - Carbon deposits in the cylinder

10. The owner of a sport utility vehicle installed larger wheels and tires than specified. Technician A says that the vehicle will likely accelerate slower than before the change. Technician B says that the fuel economy (gas mileage) will be calculated as being lower than before the change. Which technician is correct?
- Technician A only
  - Technician B only
  - Both Technicians A and B
  - Neither Technician A nor B
11. The owner of a vehicle equipped with a positive backpressure-type EGR valve system installs a low restriction exhaust system. What is the *most likely* result?
- Reduced performance and fuel economy
  - Possible spark knock and increased NO<sub>x</sub> exhaust emissions
  - Rough idle and possible excessive CO exhaust emissions
  - Reduced performance and possible excessive HC exhaust emissions
12. The temperature gauge on a vehicle was starting to read into the red (danger) zone. An inspection of the engine indicated that the serpentine belt was loose. What is *most likely* to be the root cause of the problem?
- A defective belt
  - An incorrect water pump
  - A clogged radiator
  - A broken belt tensioner spring
13. The air pump switching valves were discovered to have melted due to excessive heat. Which is the *most likely* root cause?
- A loose AIR pump drive belt
  - A broken one-way exhaust check valve
  - An EGR valve that is stuck open
  - A cracked exhaust manifold
14. An engine has had repeated oil pump failures. Each time the oil pickup screen is covered with silicone sealer restricting the flow of oil. What is the *most likely* root cause of this repeated component failure?
- The use of the wrong RTV sealer on the gaskets
  - The use of too much RTV sealer
  - Defective intake manifold gaskets that are being distorted by gasoline and the parts are falling into the oil pan
  - The use of the wrong type of engine oil, which is dissolving the RTV sealer

15. A broken valve spring is suspected. Which tests could best detect a broken valve spring?
- Running compression; cranking vacuum
  - Running compression; running vacuum
  - Cranking compression; cranking vacuum
  - Scope firing lines; cranking vacuum

### Answers to Sample Questions

- The correct answer is c.** Both technicians are correct. Technician A is correct because if the wrong PCV valve is used too much or too little air will be drawn through the crankcase ventilation system resulting in an incorrect or variable air-fuel mixture. About 20% of the air needed by the engine flows through the PCV system. Oxygen sensor input and fuel trim is often not a correcting factor on many vehicles equipped with OBD-I. Technician B is correct because the extra air being drawn into the closed system through the open oil filler cap is air not being measured by the MAF sensor and will, therefore, cause the air-fuel mixture to be too lean for normal engine operation. Answers **a**, **b**, and **d** are not correct because both technicians are correct.
- The correct answer is b.** This is an “except”-type of question and service information is available from all except the owner’s manual, even though it may contain some specifications and other important information. Answer **a** is not correct because the service manual is the primary source of service information for many vehicles. Answer **c** is not correct because electronic information is a major source of service information for many vehicles. Answer **d** is not correct because many vehicle manufacturers now have service information on secure Web sites.
- The correct answer is d.** All of the above. Answer **a** is correct because a defective spark plug wire could cause a misfire and knowing the resistance specification is needed. Answer **b** is correct because the vehicle identification number (VIN) is needed for TSBs and other service information regarding computer updates and other reasons that could relate to a random misfire DTC. Answer **c** is correct because the engine code is needed to correctly identify the correct TSB or test procedure to follow.
- The correct answer is a.** The oxygen sensor is not an effective input sensor until the engine has been running long enough to heat the sensor to about 600°F (315°C) and is therefore not likely to be the cause of hard starting problems. Answer **b** is not correct because the engine coolant temperature (ECT) is a major input as to the fuel mixture needed by the engine during a cold start. Answer **c** is not correct because the camshaft position (CMP) sensor is used by the PCM to trigger the fuel injection pulses on many engines and is therefore important for the normal starting of a fuel-injected engine. Answer **d** is not correct because the crankshaft position (CKP) sensor is a major input to the PCM during cranking and represents engine speed (RPM). A fault with this sensor will definitely cause a starting problem. Answers **b**, **c**, and **d** are not correct because all of these sensors are important and could affect the starting of the engine.

5. **The correct answer is c.** Both technicians are correct. Technician A is correct because a loose harmonic balancer pulley could create a vibration that is interpreted by the PCM as engine detonation. The knock sensor would signal the PCM to retard ignition timing, but because the vibration is not actually caused by detonation, the vibration continues and thereby triggers the KS DTC. Technician B is correct because an excessively lean air-fuel mixture can cause engine detonation, and even though the ignition timing would be retarded, it may not be enough to reduce the detonation and thereby trigger the knock sensor DTC. Answers **a**, **b**, and **d** are not correct because both technicians are correct.
6. **The correct answer is a.** Technician A only is correct because the vehicle only overheats during slow speed driving when airflow through the radiator is reduced. At higher vehicle speeds, there is enough airflow through the radiator to provide for proper engine cooling. Answer **b** is not correct because a partially clogged radiator is more likely to cause the engine to overheat while driving at highway speed where greater coolant flow is occurring due to increased engine speed. Answers **c** and **d** are not correct because only Technician A is correct.
7. **The correct answer is a.** The *least likely* cause of overheating at highway speeds only would be a defective fan clutch. Airflow through the radiator at highway speeds should be enough to provide for sufficient cooling. Answers **b**, **c**, and **d** are not correct because all three could be reasons why the engine can overheat at highway speeds when coolant flow is higher than during slow speed driving.
8. **The correct answer is c.** Both technicians are correct. Technician A is correct because a pressure test can often locate engine coolant leaks that are overlooked or cannot be observed during a routine visual inspection. Technician B is correct because if unburned hydrocarbons (HC) are measured from the radiator fill opening, combustion gases must be getting into the cooling system. A defective head gasket is the most likely cause. Answers **a**, **b**, and **d** are not correct because both technicians are correct.
9. **The correct answer is c.** A partially clogged catalytic converter is not likely to cause excessive NO<sub>x</sub> exhaust emissions because the increased backpressure would tend to decrease engine vacuum, which in turn would tend to enrich the air-fuel mixture, thereby reducing the tendency to create excessive NO<sub>x</sub> exhaust emissions. Excessive NO<sub>x</sub> emissions are usually caused by a hot or lean running engine. Answer **a** is not correct because a partially clogged radiator could cause the engine to run hotter than normal and therefore be likely to create excessive NO<sub>x</sub> exhaust emissions. Answer **b** is not correct because a lean air-fuel mixture tends to burn hotter than normal and is likely to cause excessive NO<sub>x</sub> exhaust emissions. Answer **d** is not correct because carbon deposits in the cylinder have the effect of increasing the compression, thereby increasing the possibility of creating excessive NO<sub>x</sub> exhaust emissions.

- 10. The correct answer is c.** Both technicians are correct. Technician A is correct because the larger wheels and tires will travel farther with each revolution, requiring more torque from the engine, thereby reducing the acceleration rate compared to the same vehicle equipped with stock size wheels and tires. Technician B is correct because even though the engine will be rotating slower at a particular vehicle speed, the odometer will register fewer miles than the actual distance. When the amount of gasoline is divided into the lower number of miles traveled the result is a lower-than-normal calculated miles per gallon figure. Answers **a**, **b**, and **d** are not correct because both technicians are correct.
- 11. The correct answer is b.** The low restriction exhaust system reduces backpressure. Exhaust system backpressure is needed to close a vent valve in a positive-backpressure-type EGR valve. Reduced backpressure, therefore, can prevent the EGR from opening properly, increasing the chances of spark knock (pinging) and creating excessive NO<sub>x</sub> exhaust emissions. Answer **a** is not correct because a low restriction exhaust usually increases performance and fuel economy even though the opposite can occur. Answer **c** is not correct because if the EGR does not open, it is unlikely to be the cause of a rough idle. Excessive CO exhaust emission is usually caused by a rich air-fuel mixture and the installation of a low restriction exhaust would tend to cause the mixture to be leaner (not richer). Answer **d** is not correct because the low restriction exhaust is likely to increase performance and is unlikely to cause an increase in HC exhaust emission, which is the result of incomplete combustion or lack of proper ignition of the air-fuel mixture.
- 12. The correct answer is d.** The most likely cause of a loose serpentine accessory drive belt is a broken tensioner spring. Answer **a** is not correct because even though a defective belt could be the cause, it is not the most likely cause of loose belt tension. Answer **b** is not correct because even though an incorrect water pump could cause the engine to overheat, it is doubtful that it could cause the drive belt to be loose unless the replacement pump came equipped with an undersize pulley. Answer **c** is not correct because even though a clogged radiator could cause the engine to overheat, it cannot cause the serpentine accessory drive belt to be loose.
- 13. The correct answer is b.** A broken one-way exhaust check valve is the most likely cause of excessive heat destroying the air pump switching valves. The valves are designed to allow air to flow from the AIR pump to the exhaust manifold and to block the flow of hot exhaust gases back up into the hoses and switches in the system. Answer **a** is not correct because a loose AIR pump belt, while it could cause noise and prevent the pump from working correctly, would be unlikely to cause the switching valves to fail due to heat. Answer **c** is not correct because a stuck open EGR valve would drastically affect engine operation, but would not create a problem where exhaust gases could get to the AIR switching valves. Answer **d** is not correct because while a cracked exhaust manifold could cause some exhaust to leak out, it is unlikely that the crack would align with and melt the AIR switching valves which are usually located near the AIR pump at the front of the engine.

14. **The correct answer is b.** The use of too much RTV sealer will result in some of the extra material dropping off of the oil pan/block rail and falling into the oil pan where it is picked up and clogs the oil pump screen. Answer **a** is not correct because even though the wrong type of RTV sealer could damage oxygen sensors, it is the use of too much rather than the type of sealer used that has caused the repeated problem. Answer **c** is not correct because it is unlikely to be the cause of repeated failure and the intake manifold gaskets are designed to withstand the effects of gasoline and gasoline additives. Answer **d** is not correct because oil cannot dissolve RTV sealer regardless of the type, brand, or viscosity.
15. **The correct answer is b.** A broken vacuum spring will likely prevent the valve from closing properly, therefore it could be best detected during a vacuum test at idle (fluctuating vacuum reading) and when performing a compression test at idle speed (all spark wires are connected except for the cylinder being tested). A lower than average reading on a running compression test usually indicates a valve train-related problem. Answer **a** is not correct because a cranking vacuum test would be unlikely to determine a fault with a broken valve spring due to the slow engine speed during cranking, which allows time for the valve to close completely even if the spring was broken. Answer **c** is not correct because, again, cranking vacuum is not a good test to detect a broken valve spring. Answer **d** is not correct because even though the scope firing lines could be used to detect a problem, the vacuum test during cranking would not be a good test to detect a broken valve spring.