

# Chapter 54

## Advanced Diagnostics



Name \_\_\_\_\_

Date \_\_\_\_\_

Instructor \_\_\_\_\_

Score \_\_\_\_\_

**Objective:** After studying this chapter, you will be able to use advanced diagnostic techniques to troubleshoot difficult problems.

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### Advanced Diagnostics

1. \_\_\_\_\_ diagnostics involves using a consistent, logical \_\_\_\_\_ procedure to narrow down possible problem sources.
2. A customer complains that his vehicle misses only when cold. Technician A says the first step in diagnosing the problem is to perform service manual–recommended tests. Technician B says that the first step in diagnosing the problem is to verify the customer’s complaint. Who is right?  
(A) A only.  
(B) B only.  
(C) Both A and B.  
(D) Neither A nor B.

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### Advanced Scan Tool Tests

3. A scan tool \_\_\_\_\_ is an instantaneous reading of the \_\_\_\_\_ operating parameters that are present when a problem occurs.
4. A scan tool’s \_\_\_\_\_ feature requires the technician to \_\_\_\_\_ monitor operating conditions and to press a button on the scan tool when the problem occurs.
5. What are scan tool datastream values?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. Most scan tools can switch computer-controlled \_\_\_\_\_ on and off.

7. *True or False?* Many scan tools can be used to fire an \_\_\_\_\_ ignition coil, control the idle speed motor, or disable a fuel injector while connected to the vehicle's ECM.

- \_\_\_\_\_ 8. The \_\_\_\_\_ will usually specify the electrical values that should be present at each terminal of the multi-pin computer or ECM connector.
- (A) service manual/information
  - (B) flat-rate manual
  - (C) owner's manual
  - (D) breakout box

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## Checking ECM Terminal Values

9. A(n) \_\_\_\_\_ allows you to check electrical values at specific pins on the ECM or in a wiring harness.

- \_\_\_\_\_ 10. Tests using a breakout box indicate that the MAP sensor signal is not within specifications. Technician A says the sensor may be defective. Technician B says there may be a problem in the wiring between the sensor and the breakout box. Who is right?
- (A) A only.
  - (B) B only.
  - (C) Both A and B.
  - (D) Neither A nor B.

11. What is *electromagnetic interference (EMI)*?

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- \_\_\_\_\_ 12. All of the following are potential sources of electromagnetic interference, *except*:
- (A) shielded spark plug wires.
  - (B) police and CB radios.
  - (C) misrouted wiring.
  - (D) some aftermarket accessories.

13. How can you use a small transistor radio to find electromagnetic interference that could upset computer system operation?

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14. What two general repair methods must be used to correct an EMI problem?

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Name \_\_\_\_\_

15. Name five things a digital thermometer can be used to check during diagnosis.

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16. How can you check to see if temperature extremes are affecting ECM operation?

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17. A(n) \_\_\_\_\_ is used to measure an engine's power output and performance.

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## Using an Oscilloscope

18. Oscilloscopes are a piece of test equipment that displays voltages in relation to \_\_\_\_\_.

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19. The oscilloscope's ability to draw a(n) \_\_\_\_\_, or waveform (pattern of circuit voltages), for very short time spans makes it very useful for testing ignition, sensor, and computer system performance.

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20. What is the most commonly used value on a scope screen?

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21. If the scope is set to read 0–10 volts for checking the ECM, a waveform five divisions tall indicates \_\_\_\_\_ volts peak-to-peak.

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22. The most common scope time scale used is \_\_\_\_\_.

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23. Scope sweep rate is the \_\_\_\_\_ shown on the screen during each test.

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24. What is the advantage of being able to adjust the scope sweep rate?

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- \_\_\_\_\_ 25. A shorted component would produce a \_\_\_\_\_ voltage trace.

- (A) higher-than-normal  
 (B) normal  
 (C) lower-than-normal  
 (D) flat

26. The \_\_\_\_ scope pattern shows the low-voltage changes \_\_\_\_\_  
in an ignition system.

- \_\_\_\_\_ 27. A problem in the primary circuit will usually affect the \_\_\_\_.
- (A) primary pattern
  - (B) secondary pattern
  - (C) secondary circuit
  - (D) All of the above.

28. What problems will the firing section pinpoint?

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29. The \_\_\_\_ is the tall spike or line representing the \_\_\_\_\_  
amount of voltage needed to cause the electric arc to  
jump across the spark plug gap.

- \_\_\_\_\_ 30. Which of the following secondary pattern sections shows voltage fluctuations after the plug stops firing?
- (A) Intermediate section.
  - (B) Spark line.
  - (C) Firing section.
  - (D) Dwell section.

- \_\_\_\_\_ 31. The secondary dwell section will indicate problems with the \_\_\_\_.
- (A) camshaft position sensor
  - (B) ignition module
  - (C) throttle position sensor
  - (D) mass airflow sensor

32. Define the term *superimposed* and its significance to scope test patterns.

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33. The \_\_\_\_ superimposed pattern is one of the most \_\_\_\_\_  
commonly used scope patterns, and shows the high  
voltages produced by the ignition coils.

34. Describe a parade pattern.

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Name \_\_\_\_\_

- \_\_\_\_\_ 35. Technician A says a tall firing line indicates high resistance in the ignition secondary. Technician B says a tall firing line may be caused by a burned coil-to-plug connection. Who is right?  
 (A) A only.  
 (B) B only.  
 (C) Both A and B.  
 (D) Neither A nor B.

36. In a raster pattern, the bottom waveform indicates the \_\_\_\_\_ number \_\_\_\_\_ cylinder.

37. What should you look for when you read a scope pattern?  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

38. A(n) (analog/digital) \_\_\_\_\_ pattern has very short, repeating changes in voltage. \_\_\_\_\_

39. A(n) (analog/digital) \_\_\_\_\_ pattern has a smooth, gradual change in voltage over time. \_\_\_\_\_

*For questions 40–45, match the following terms and identifying phrases.*

- |   |                   |
|---|-------------------|
| _____ 40. The reference line, or zero volts.  | (A) On-time       |
| _____ 41. Where the square wave goes from zero to high voltage.                     | (B) Base line     |
| _____ 42. The portion of the square wave that stays at maximum voltage.             | (C) Amplitude     |
| _____ 43. The drop in voltage back to zero.   | (D) Trailing edge |
| _____ 44. Where the square wave stays on the baseline.                              | (E) Rising edge   |
| _____ 45. Determined by the horizontal distance from the baseline to the high-time. | (F) Off-time      |

- \_\_\_\_\_ 46. All of the following can affect a square wave, *except*:  
 (A) low resistance in the circuit.  
 (B) faulty circuit.  
 (C) amplitude.  
 (D) moisture contamination.

47. Which four things should you check with sine wave signals?  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

48. What should you do to probe sealed electrical connectors?  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- \_\_\_\_\_ 49. If one of a crankshaft position sensor waveform's peak-to-peak voltages is short or missing, what should you check for?
- (A) Broken tooth on the trigger wheel.
  - (B) Debris in the trigger wheel area.
  - (C) Defective sensor.
  - (D) Unplugged connector.

50. *True or False?* A typical throttle position sensor (TPS) \_\_\_\_\_ waveform should show curves with spikes.

51. How is a scope used to test a knock sensor?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

52. Since \_\_\_\_\_ testing varies and is complex, always refer \_\_\_\_\_ to the service manual for detailed instructions.

53. A(n) \_\_\_\_\_ involves using a multimeter to measure the \_\_\_\_\_ actual voltages being sent out by the ECM to resistive sensors.

54. What is a flight record test?

\_\_\_\_\_

\_\_\_\_\_

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## Diagnostic Laptop Computers and Tablets

55. List three features of an automotive diagnostic laptop computer or tablet.

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