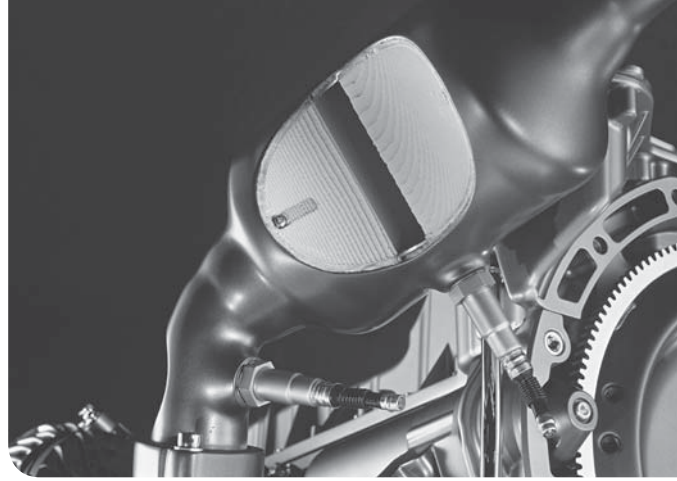


# Chapter 51

## Emission Control System Technology



Name \_\_\_\_\_

Date \_\_\_\_\_

Instructor \_\_\_\_\_

Score \_\_\_\_\_

**Objective:** After studying this chapter, you will be able to explain the operating principles of emission control systems.

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### Air Pollution

1. Why are emission control systems used on cars and trucks?

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2. Name some things that produce natural air pollution and man-made air pollution.

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3. What is formed when airborne pollutants combine with oxygen, nitrogen, and other elements in the presence of sunlight?

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*For questions 4–7, match the following terms and identifying phrases.*

- |       |   |   |
|-------|---|---|
| _____ | 4. Emissions produced by extremely high temperatures during combustion.                         | (A) Hydrocarbons                          |
| _____ | 5. The release of unburned fuel into the atmosphere.  | (B) Carbon monoxide                       |
| _____ | 6. Solid particles of carbon soot or ash and fuel additives that blow out a vehicle's tailpipe. | (C) Oxides of nitrogen (NO <sub>x</sub> ) |
| _____ | 7. Toxic emission resulting from the release of partially burned fuel.                          | (D) Particulates                          |

8. What percentage of all particulate emissions float in the air for extended periods of time?

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9. Name the three basic sources that produce vehicle emissions.

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10. Identify and explain two engine modifications designed to reduce exhaust emissions.

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## Vehicle Emission Control Systems

For questions 11–16, match the emission control systems listed with the statement that best describes its function.

- |   |   |
|---|---|
| _____ 11. Forces outside air into the exhaust ports or catalytic converter to help burn unburned fuel.                        | (A) Positive crankcase ventilation (PCV) system |
| _____ 12. Recirculates engine crankcase fumes back into the combustion chambers.  | (B) Evaporative emissions control (EVAP) system |
| _____ 13. Chemically changes exhaust by-products into harmless substances.  | (C) Exhaust gas recirculation (EGR) system      |
| _____ 14. Injects burned exhaust gases into engine to lower combustion temperature and prevent formation of NO <sub>x</sub> . | (D) Air injection system                        |
| _____ 15. Closed vent system that prevents fuel vapors from entering atmosphere.  | (E) Catalytic converter                         |
| _____ 16. Electronic controls used to monitor and interface with various systems to increase efficiency and reduce emissions. | (F) Computer control system                     |

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## Positive Crankcase Ventilation

17. A positive crankcase ventilation (PCV) system uses \_\_\_\_\_ engine \_\_\_\_\_ to draw blowby gases into the intake manifold for re-burning in the combustion chambers.

- \_\_\_\_\_ 18. Engine blowby gases contain \_\_\_\_\_.  
(A) unburned fuel (HC)  
(B) partially burned fuel (CO)  
(C) particulates  
(D) All of the above.

19. Name four undesirable conditions caused by engine blowby gases.

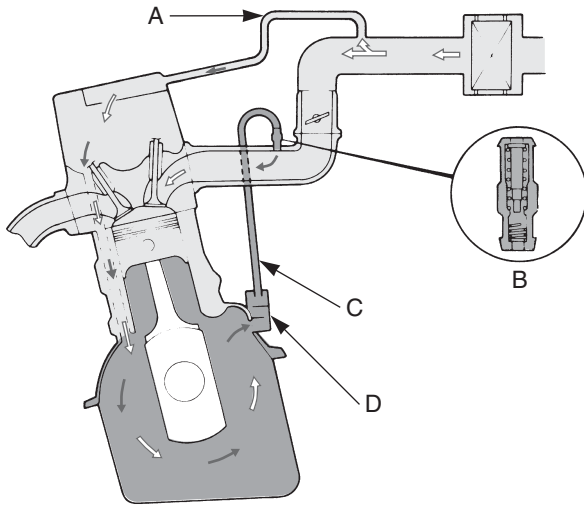
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Name \_\_\_\_\_

- 20. A(n) \_\_\_\_ PCV system uses a sealed oil filler cap, a sealed oil dipstick, ventilation hoses, and either a PCV valve or a flow restrictor. \_\_\_\_\_
- 21. A PCV \_\_\_\_ is used to control the flow of air through the PCV system. \_\_\_\_\_
- 22. Identify the parts of the PCV system illustrated below.



- (A) \_\_\_\_\_
- (B) \_\_\_\_\_
- (C) \_\_\_\_\_
- (D) \_\_\_\_\_

- 23. What is the device that makes oil vapors condense and flow back into the oil pan?  
\_\_\_\_\_

## Evaporative Emissions Control Systems

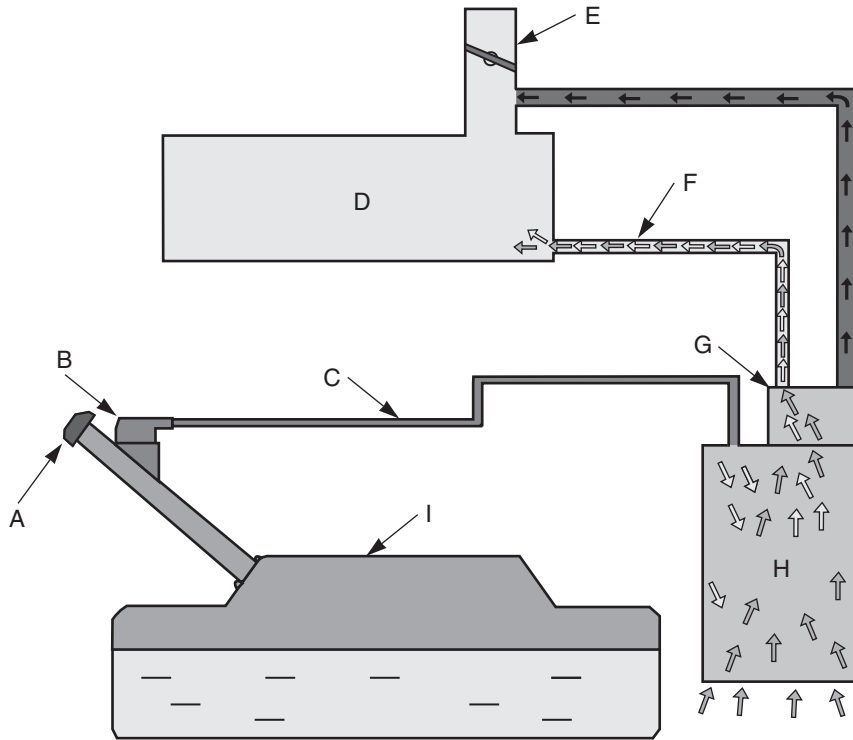
- 24. The EVAP system uses a(n) \_\_\_\_ fuel tank cap to prevent fuel vapors from entering the atmosphere. \_\_\_\_\_

- \_\_\_\_\_ 25. The air dome normally provides \_\_\_\_% airspace to allow for fuel heating and the resulting volume increase to prevent fuel spillage.
  - (A) 5
  - (B) 10
  - (C) 25
  - (D) 50

- 26. What type of component can be used to keep liquid fuel from entering the evaporative emission system?  
\_\_\_\_\_

- 27. What function does a rollover valve serve?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

28. Identify the parts of the evaporative emissions control system illustrated below.



- |           |           |
|-----------|-----------|
| (A) _____ | (F) _____ |
| (B) _____ | (G) _____ |
| (C) _____ | (H) _____ |
| (D) _____ | (I) _____ |
| (E) _____ |           |

29. What is the purpose of the charcoal canister?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

30. A purge (line/valve) \_\_\_\_\_ controls the flow of vapors \_\_\_\_\_ from the canister to the intake manifold.

31. A purge (line/valve) \_\_\_\_\_ is used for removing the \_\_\_\_\_ stored vapors from the charcoal canister.

\_\_\_\_\_ 32. When the engine is operating \_\_\_\_\_ idle speed, intake manifold vacuum causes the purge valve to open.

(A) at

(B) below

(C) above

(D) None of the above.

Name \_\_\_\_\_

33. What happens to gasoline when the engine is shut off?

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34. List three additional components found on an enhanced evaporative emissions control system and explain the function of each.

(A) \_\_\_\_\_

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(B) \_\_\_\_\_

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(C) \_\_\_\_\_

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35. What is used to absorb fuel vapors when the engine is shut off?

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## Exhaust Gas Recirculation (EGR)

36. How does an electronic EGR system operate?

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37. What two components make up a basic vacuum EGR system?

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38. How does an electronic-vacuum operated EGR valve work?

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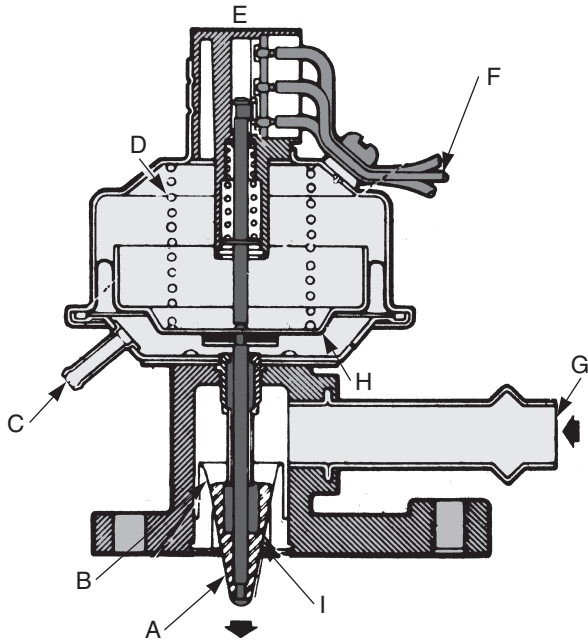


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39. Label the components of the EGR valve illustrated below.



- (A) \_\_\_\_\_
- (B) \_\_\_\_\_
- (C) \_\_\_\_\_
- (D) \_\_\_\_\_
- (E) \_\_\_\_\_
- (F) \_\_\_\_\_
- (G) \_\_\_\_\_
- (H) \_\_\_\_\_
- (I) \_\_\_\_\_

40. What is the most common type of EGR system used on late-model engines?

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41. The EGR \_\_\_\_ is a measurement of control current on \_\_\_\_\_ and off time sent from the ECM.

42. An electronic EGR valve works \_\_\_\_ engine vacuum. \_\_\_\_\_

43. What is the difference between a single-stage EGR valve and a multi-stage EGR valve?

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## Air Injection System

44. Describe an air injection system.

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Name \_\_\_\_\_

45. What air injection system component is belt-driven and forces air at low pressure into the system?

\_\_\_\_\_

\_\_\_\_\_ 46. The \_\_\_\_\_ of an air injection system keeps air from entering the exhaust system during deceleration.

- (A) vacuum valve
- (B) diverter valve
- (C) air injection pump
- (D) None of the above.

47. How is backfiring prevented in an air injection system?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

48. What is used in air injection systems to direct a stream of air toward each engine exhaust valve?

\_\_\_\_\_

49. Some vehicles also use the air injection system to force air into the \_\_\_\_\_ to help it burn, or oxidize, the partially burned fuel more completely.

\_\_\_\_\_

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## Pulse Air System

50. The \_\_\_\_\_ valves in a pulse air system block airflow in one direction and allow airflow in the other direction.

\_\_\_\_\_

51. How does a pulse air system operate?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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## Catalytic Converter

For questions 52–55, match the following terms and identifying phrases.

- |   |                                  |
|---|----------------------------------|
| _____ 52. Can reduce only two types of exhaust emissions.                     | (A) Reduction-type converter     |
| _____ 53. Can reduce HC, CO, and NO <sub>x</sub> exhaust emissions.           | (B) Oxidation converter          |
| _____ 54. A very small converter placed close to the engine exhaust manifold. | (C) Mini catalytic converter     |
| _____ 55. Contains separate catalyst units enclosed in a single housing.      | (D) Dual-bed catalytic converter |

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## Computerized Emission Control Systems

- \_\_\_\_\_ 56. A perfect stoichiometric fuel mixture is \_\_\_\_\_ air-fuel by weight.  
(A) 2.5:1  
(B) 7.7:1  
(C) 10.2:1  
(D) 14.7:1
57. A low percentage of oxygen in the engine exhaust gases indicates a \_\_\_\_\_ (lean/rich) fuel mixture. \_\_\_\_\_
58. The \_\_\_\_\_ oxygen sensor is used to monitor the oxygen in the exhaust gases leaving the engine. \_\_\_\_\_
59. The \_\_\_\_\_ oxygen sensor is mounted downstream in the exhaust system and can be used to check the exhaust gas for oxygen content of exhaust gases entering the catalytic converter. \_\_\_\_\_
60. How are oxygen sensor positions numbered?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
61. What benefit do heated oxygen sensors provide?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
62. Most heated O<sub>2</sub> sensors are also called \_\_\_\_\_ oxygen sensors. \_\_\_\_\_



Name \_\_\_\_\_

- \_\_\_\_\_ 63. A(n) \_\_\_\_\_ oxygen sensor has the advantage of an almost instant oxygen content signal upon cold startup.
- (A) zirconia
  - (B) heated
  - (C) titania
  - (D) None of the above.

64. As the oxygen content of the exhaust changes, the \_\_\_\_\_ of the sensor also changes.

65. Describe a wide-band oxygen sensor.

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## OBD II Emission System Monitoring

- \_\_\_\_\_ 66. Most OBD II systems will monitor \_\_\_\_\_.
- (A) EGR valve action
  - (B) catalytic converter efficiency
  - (C) evaporative emissions system operation
  - (D) All of the above.

67. OBD II evaporative emissions systems monitoring checks components for \_\_\_\_\_ and \_\_\_\_\_.

68. *True or False?* OBD II EGR monitoring is done when the computer turns the EGR on while checking O<sub>2</sub> sensor readings.

69. Air injection system monitoring uses data from the \_\_\_\_\_ O<sub>2</sub> sensor to determine if the right amount of air is being injected into the engine's exhaust system.

70. *True or False?* The catalyst monitor is located after the catalytic converter.

71. What does it mean if the signal from the catalyst monitor becomes too similar to the engine-mounted oxygen sensor signal(s)?

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## Diesel Particulate Filter

72. How do diesel particulate filters help the environment?

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