Chapter 12

Engine Design Classifications

Name: _______________________ Date: ___________________
Instructor: ___________________ Score: ____________

Textbook pages 158–175

Objective: After studying this chapter, you will be able to describe and explain basic automotive engine designs and classifications.

Cylinder Arrangement

1. Define cylinder arrangement.

2. Name the four basic cylinder arrangements.

3. The cylinders of a(n) __ engine are lined up in a single row.

4. A(n) __ engine has only one bank of cylinders.

5. Cylinders of a(n) __ engine lie flat on either side of the crankshaft.

Number of Cylinders

6. Normally, car and truck engines have either ____ cylinders.
   (A) 4, 5, or 6
   (B) 2, 4, or 6
   (C) 4, 6, or 8
   (D) 6, 10, or 12

7. A greater number of cylinders generally ____ (increases/decreases) engine smoothness and power.

8. A(n) ____ cylinder engine produces twice as many power strokes per crank revolution as a(n) ____ cylinder engine.
   (A) 3, 8
   (B) 8, 4
   (C) 6, 10
   (D) None of the above.
20. Gasoline engines use __ ignition.
21. A diesel engine is a(n) __ ignition engine.

Valve Location

22. A(n) ___ engine has both the intake and exhaust valves in the block.
23. A(n) ___ engine has both valves in the cylinder head.
24. Identify the parts of the valve-in-block arrangement illustrated below.

![Valve-in-block arrangement diagram]

25. What type of valve-camshaft arrangement is illustrated below? Label the parts as indicated.

![Valve-camshaft arrangement diagram]
Cylinder Numbering and Firing Order

9. Why do engine manufacturers number each engine cylinder?

10. Cylinder numbers are normally stamped on an engine’s _____ rods or they are sometimes cast into the _____.

11. Define firing order.

12. When is it important to know an engine’s firing order?

Cooling System Type

13. Explain how a liquid cooling system operates.

14. _____ cooled engines are seldom used in passenger cars.

15. An air cooling system circulates air over _____ on the cylinders to prevent overheating.

Fuel Type

16. An engine can be classified by the type of _____ it burns.

17. Name at least three types of fuels used in automotive engines.

18. What are the two most common types of fuel for vehicles?

Ignition Type

19. Explain the difference between a spark ignition engine and a compression ignition engine.
26. What type of valve-camshaft arrangement is illustrated below? Label the parts as indicated.

![Diagram of valve-camshaft arrangement]

(A) 
(B) 
(C) 
(D) 
(E) 
(F) 
(G) 
(H) 
(I) 

27. Name the two basic locations for the engine camshaft. 

28. A(n) ___ engine uses pushrods to transfer motion to the rocker arms and valves and a(n) ___ engine has the camshaft in the cylinder head. 

29. A(n) ___ engine has only one camshaft per cylinder head. 

30. The ___ arrangement is frequently used in engines equipped with four-valve combustion chambers.

31. List the three types of combustion chamber designs. 

32. The ___ combustion chamber has valve heads that are almost parallel to the top of the piston. 

33. In a(n) ___ combustion chamber, the spark plug is located near the center.
Combustion Chamber Types

34. A(n) __ combustion chamber is designed to cause the air-fuel mixture to swirl, or spin, as it enters from the ____ port.

35. The extra valves in a(n) ____ combustion chamber increase flow in and out of the chamber.

36. A three-valve combustion chamber has ____ intake valve(s) and ____ exhaust valve(s).
   (A) 1, 2
   (B) 2, 1
   (C) 3, 3
   (D) None of the above.

37. Briefly describe the operation of a stratified charge combustion chamber.

38. A(n) ____ combustion chamber has a single chamber fitted with an extra air valve.

Alternative Engines

Fill in the blanks of the statements on the left with the correct term from the list on the right.

39. A(n) ____ engine uses a triangular rotor instead of conventional pistons.
   (A) two-stroke engine
   (B) two-stroke-cycle engine
   (C) external
   (D) Miller-cycle
   (E) rotary

40. A steam engine is a(n) ____ combustion engine.

41. A(n) ____ only requires one revolution of the crankshaft for a complete power-producing cycle.
   (D) Miller-cycle

42. A(n) ____ uses a mixture of fuel and oil.

43. A(n) ____ is designed with a short compression stroke and a long power stroke to increase efficiency.
Typical Automotive Engines

44. Label the parts of the fuel-injected V-8 engine illustrated below. Indicate the type(s) of metal used in each part's construction.

(A) ____________________________  (H) ____________________________
(B) ____________________________  (I) ____________________________
(C) ____________________________  (J) ____________________________
(D) ____________________________  (K) ____________________________
(E) ____________________________  (L) ____________________________
(F) ____________________________  (M) ____________________________
(G) ____________________________  (N) ____________________________