

# Chapter 39

## Automotive Fuels, Combustion Efficiency



Name \_\_\_\_\_

Date \_\_\_\_\_

Instructor \_\_\_\_\_

Score \_\_\_\_\_

**Objective:** After studying this chapter, you will be able to summarize how crude oil is converted into gasoline, diesel fuel, liquefied petroleum gas, and other products.

1. Name the three forms of fuel.

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

2. Define *combustion*.

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

3. A measure of how well combustion consumes all the fuel's heat energy for maximum cylinder pressure (propulsion) and minimum exhaust by-products (pollution) is called \_\_\_\_\_.

\_\_\_\_\_

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### Petroleum (Crude Oil)

4. Define *crude oil*.

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

5. What are hydrocarbons?

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

6. A(n) \_\_\_\_\_ converts crude oil into more useful substances.

\_\_\_\_\_

7. \_\_\_\_\_ is the first crude oil conversion process.

\_\_\_\_\_

8. Define *fractionating tower*.

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## Gasoline

9. Gasoline is the most common type of \_\_\_\_.

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10. \_\_\_\_ slow down the burning of gasoline.

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11. Define *octane rating*.

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\_\_\_\_\_ 12. Octane numbers \_\_\_\_.

- (A) give the antiknock value of gasoline
- (B) are given on the side of the gas station pump
- (C) represent the fuel's ability to resist ping
- (D) All of the above.

13. Describe the purpose of octane enhancers.

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14. In order for gasoline to burn properly, it must be mixed \_\_\_\_\_  
with the right amount of \_\_\_\_.

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15. When does normal gasoline combustion occur?

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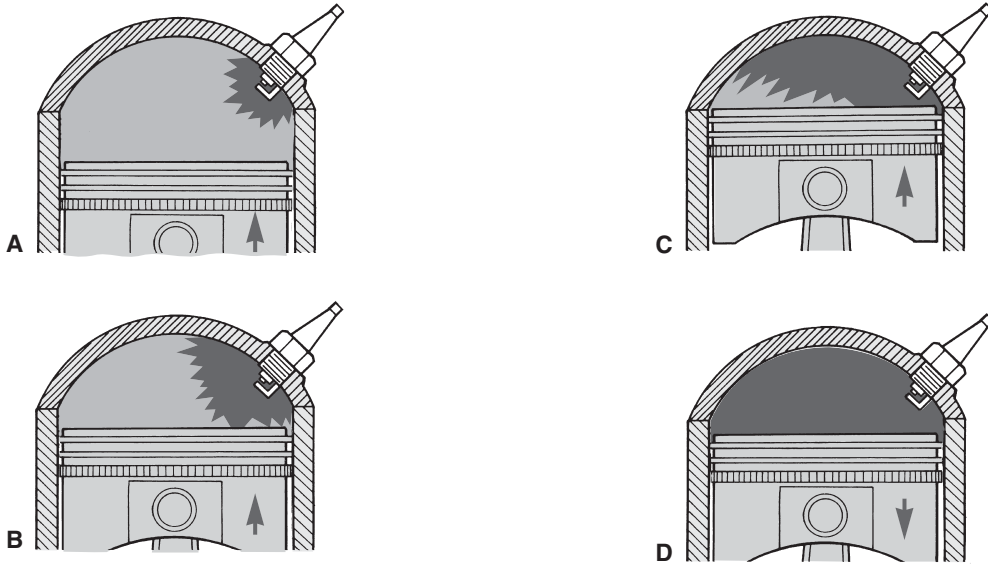
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Name \_\_\_\_\_

16. Describe the stages of normal combustion shown below.



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

17. Define *stoichiometric fuel mixture*.

\_\_\_\_\_

18. What is the stoichiometric fuel mixture for gasoline?

\_\_\_\_\_

19. A lean air-fuel mixture contains a large amount of \_\_\_\_\_ compared to \_\_\_\_\_.

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

20. A(n) \_\_\_\_\_ air-fuel mixture is the opposite of a lean mixture.

\_\_\_\_\_

21. A slightly lean mixture is desirable for \_\_\_\_\_ gas mileage and \_\_\_\_\_ exhaust emissions.

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

22. A(n) \_\_\_\_\_ mixture will reduce engine power, foul spark plugs, and cause incomplete burning.

\_\_\_\_\_

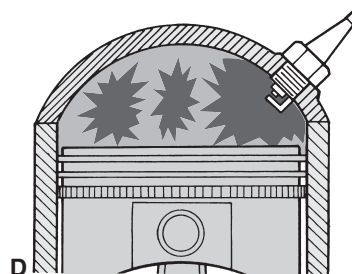
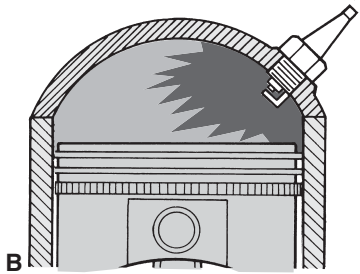
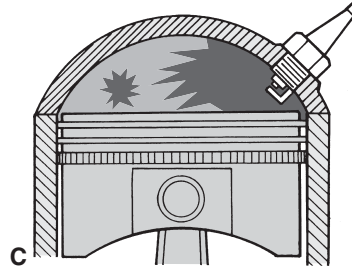
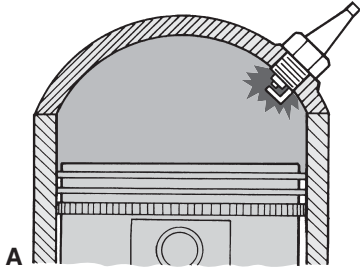
23. When does abnormal combustion occur?

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

24. Define *detonation*.

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

25. Identify the four stages of detonation.



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

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

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

(D) \_\_\_\_\_

26. Describe how detonation can damage an engine.

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27. \_\_\_\_\_ results when an overheated surface in the combustion chamber ignites the air-fuel mixture. \_\_\_\_\_

28. What is another word for mild knock?  
\_\_\_\_\_

29. Define *dieseling*.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

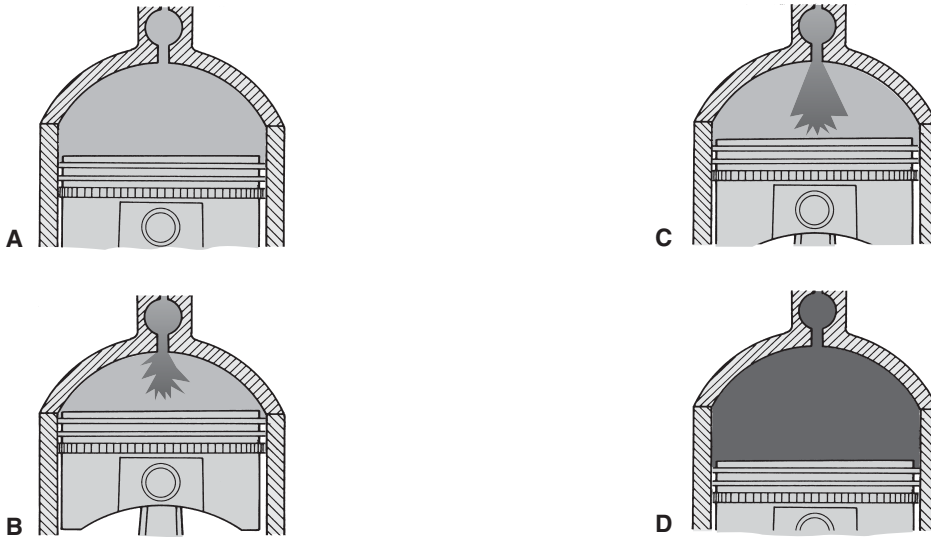
30. \_\_\_\_\_ is an engine combustion problem caused by the spark plug firing too soon in relation to the position of the piston. \_\_\_\_\_

Name \_\_\_\_\_

**Diesel Fuel**

31. Diesel fuel can produce more cylinder \_\_\_\_\_ and vehicle \_\_\_\_\_ than an equal amount of gasoline. \_\_\_\_\_
32. Diesel engines inject the diesel fuel directly into the \_\_\_\_\_. \_\_\_\_\_
33. Diesel fuel will not \_\_\_\_\_ as easily as gasoline. \_\_\_\_\_
34. Diesel fuel grades ensure that diesel fuel sold all over the country has \_\_\_\_\_. \_\_\_\_\_
35. What diesel fuel grade is normally recommended for use in diesel automotive engines? \_\_\_\_\_
36. \_\_\_\_\_ is the thinner diesel fuel and is sometimes recommended as a winter fuel. \_\_\_\_\_
37. \_\_\_\_\_ temperatures tend to thicken diesel fuel, causing performance problems. \_\_\_\_\_
38. *True or False?* Diesel fuel contains more impurities than fuel oil. \_\_\_\_\_
39. At cloud point, the \_\_\_\_\_ can clog the fuel filters and prevent diesel engine operation. \_\_\_\_\_
40. Why is water so damaging to a diesel injection pump? \_\_\_\_\_
41. Define *cetane rating*. \_\_\_\_\_
42. Most automakers recommend a cetane rating of about \_\_\_\_\_. \_\_\_\_\_
43. Define *compression-ignition engine*. \_\_\_\_\_
44. A(n) \_\_\_\_\_ would not ignite diesel fuel properly. \_\_\_\_\_
45. *True or False?* If gasoline were used in a diesel engine, it would detonate on the compression stroke and not produce useful energy. \_\_\_\_\_

46. Identify the actions that occur during normal diesel combustion.



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

47. How does a selective catalytic reduction (SCR) system work?

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

48. Diesel exhaust fluid (DEF) is a mixture of \_\_\_\_\_ and \_\_\_\_\_.  
 \_\_\_\_\_

\_\_\_\_\_ 49. On a vehicle using a DEF dosing rate of 2% per gallon of diesel fuel burned, how many gallons of DEF would be injected for every 250 gallons of diesel fuel burned?  
 (A) Two gallons  
 (B) Three gallons  
 (C) Five gallons  
 (D) One gallon

50. Which government agency requires vehicle manufacturers to install safeguards that help prevent diesel engines from being operated in the US without DEF?

\_\_\_\_\_

## Alternative Fuels

51. What types of vehicles commonly use liquefied petroleum gas (LPG)?

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

Name \_\_\_\_\_

52. What is ethyl alcohol made from?

\_\_\_\_\_

\_\_\_\_\_

53. \_\_\_\_\_ can be made out of wood chips, petroleum, garbage, and animal manure.

\_\_\_\_\_

54. Why is gasohol commonly used as an alternative fuel in motor vehicles?

\_\_\_\_\_

55. \_\_\_\_\_ percent alcohol can increase 87 octane gasoline to 91 octane.

- (A) Five
- (B) Seven
- (C) Ten
- (D) Twelve

56. Synthetic fuels are synthesized from a(n) \_\_\_\_\_ hydrocarbon state to a(n) \_\_\_\_\_ state.

\_\_\_\_\_

\_\_\_\_\_

57. Why is hydrogen an ideal fuel?

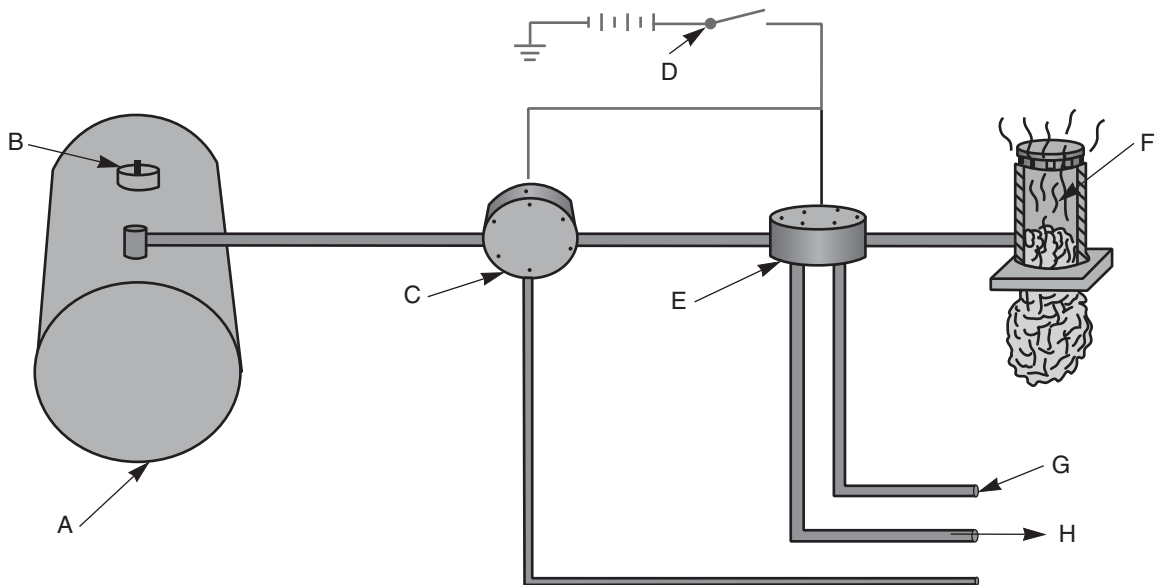
\_\_\_\_\_

\_\_\_\_\_

58. Give one reason why hydrogen is *not* presently used in vehicles.

\_\_\_\_\_

59. Identify the components and operations of the LPG fuel system illustrated below.



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