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## **Chapter 02 Test**

*Indicate the answer choice that best completes the statement or answers the question.*

1. After which 20<sup>th</sup> Century event did the thriftier diesel become regarded as a potential replacement for gasoline engines?
  - a. 1970: oil crisis in North America
  - b. 1960s: creation of OPEC
  - c. 1930s: development of compact fuel-injection equipment
  - d. 2008: financial crisis in North America
  
2. When did Rudolph Diesel (1858–1913) patent his engine?
  - a. 1899
  - b. 1892
  - c. 1900
  - d. 1883
  
3. Technician A says that diesel engines inject liquid fuel under high pressure into the combustion chamber near the end of the intake stroke. Technician B says that air that is heated during the compression stroke becomes the ignition source. Who is right?
  - a. A only
  - b. B only
  - c. Both A and B
  - d. Neither A nor B
  
4. Inspiration for the engine concept may have occurred when Rudolf Diesel observed a demonstration of a device used to:
  - a. start fires
  - b. start steam engines
  - c. increase pressure
  - d. increase power
  
5. Which one of the following negative characteristics did NOT hinder the more widespread use of diesels?
  - a. Noisy engine operation
  - b. Poor hot weather start ability
  - c. Poor acceleration
  - d. Strong exhaust odor
  
6. At what level of efficiency did Rudolf Diesel's slow-rotating engine operate?
  - a. 25%
  - b. 50%
  - c. 75%
  - d. 100%
  
7. In 1929, Clessie Cummins, founder of Cummins Engine Company, built North America's first diesel-powered:
  - a. car
  - b. truck

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- c. boat
- d. tractor

8. Not only are diesel emissions as clean as gasoline engine mandated for 2017, but they also emit a minimum of \_\_\_\_\_ fewer exhaust emissions.

- a. 10–30%
- b. 15–35%
- c. 20–40%
- d. 40–60%

9. Typically, diesel engines will achieve between \_\_\_\_\_ better fuel economy in comparison to similar gasoline engines.

- a. 15% and 40%
- b. 25% and 70%
- c. 25% and 60%
- d. 45% and 90%

10. The diesel engine produces significantly higher \_\_\_\_\_ compared to similarly displaced gasoline-fueled engines.

- a. horsepower
- b. torque
- c. emissions
- d. speed

11. In comparison to electric vehicles, a recent study by Energy and Environment Study Institute determined the battery electric models offered for sale in the US have an average base price of \$63,000 and an average driving range of:

- a. 111 miles
- b. 211 miles
- c. 311 miles
- d. 411 miles

12. What are the CO<sub>2</sub> emissions for a diesel engine?

- a. 22.2 lb per gallon of fuel
- b. 6.2 lb per gallon of fuel
- c. 6.1 lb per gallon of fuel
- d. 20.2 lb per gallon of fuel

13. Technician A says that some studies suggest that electric vehicles may in fact be dirtier than diesel engines due to battery manufacturing. Technician B says that after including emissions from lithium-ion battery, electric vehicles generate half the emissions of a traditional internal combustion engine. Who is right?

- a. A only
- b. B only
- c. Both A and B
- d. Neither A nor B

14. Technician A says that a diesel engine's higher compression ratio helps it to produce more power and use less fuel.

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Technician B says that higher compression ratios only help the diesel engine produce more torque. Who is correct?

- a. Technician A
- b. Technician B
- c. Both A and B
- d. Neither A nor B

15. Until the development of antiknock additives for gasoline, such as tetraethyl lead in the late 1920s, compression of an air and fuel mixture was limited to the ratio:

- a. 4:1
- b. 5:1
- c. 6:1
- d. 10:1

16. While diesel engines do not have compression limits to combustion, compression ratios above what ratio provide minimal power increases?

- a. 12:1
- b. 14:1
- c. 15:1
- d. 16:1

17. Engine efficiency drops after a compression ratio of:

- a. 21:1
- b. 23:1
- c. 25:1
- d. 27:1

18. Compression pressures produce an average pre-ignition temperature of:

- a. 1,000°F
- b. 2,000°F
- c. 3,000°F
- d. 4,000°F

19. Which of the following is NOT provided by a higher compression ratio?

- a. Higher expansion ratios
- b. Improved combustion
- c. Better air-fuel mixture
- d. Lower expansion ratios

20. Smaller four-stroke diesels require a minimum cranking speed of \_\_\_\_\_ rpm to start.

- a. 150
- b. 180
- c. 125
- d. 135

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21. Technician A says that technological developments now enable the injection of gasoline directly into the combustion chamber of spark-ignited gasoline engines. Technician B says that gasoline direct-injection (GDI) engines inject gasoline near the beginning of the compression stroke. Who is right?

- a. A only
- b. B only
- c. Both A and B
- d. Neither A nor B

22. There are \_\_\_\_\_ basic combustion chamber diesel engine designs but numerous variations on both.

- a. 1
- b. 2
- c. 3
- d. 4

23. Which one of the following is NOT a reason for the IDI chamber being the most popular design in automotive applications in the early 1990s?

- a. High-speed capabilities
- b. Favorable emissions characteristics
- c. Inexpensive fuel-injection systems
- d. 10–15% greater fuel efficiency

24. DI chambers generally require no:

- a. EGR valves
- b. particulate filters
- c. oxidation catalysts
- d. starting aids

25. Technician A says that without adequate turbulence, air and fuel will not mix, resulting in lost performance and efficiency and in increased emissions. Technician B says that the semi-toroidal shape of the DI chamber is designed to mix the air and fuel. Who is right?

- a. A only
- b. B only
- c. Both A and B
- d. Neither A nor B

26. Which one of the following conditions will be produced by prolonged ignition delay in a diesel engine?

- a. An engine knocking sound.
- b. Blue smoke.
- c. White smoke.
- d. Lower peak cylinder pressures.

27. Which of the following best describes the term “ignition delay”?

- a. The time required to raise the fuel pressure high enough to overcome compression pressure in a cylinder.
- b. The time lag from initial injection to actual ignition.

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- c. The time required to heat up a glow plug.
- d. The time required for vaporized fuel to atomize.

28. Technician A says that diesel engines supply only enough air to completely burn all the fuel in the combustion chamber. Technician B says that diesel engines supply excess air to the combustion chamber to completely burn all the fuel in the combustion chamber. Who is correct?

- a. Technician A
- b. Technician B
- c. Both A and B
- d. Neither A nor B

29. Identify the points on the PV (pressure volume) graph between which uncontrolled burn period occurs.

- a. A and B
- b. B and C
- c. C and D
- d. D and E

30. Technician A says that injection quantities of fuel in a diesel engine at idle are very large. Technician B says that the cooling effect of excess air and prolonged idle has detrimental effects on the engine. Who is right?

- a. A only
- b. B only
- c. Both A and B
- d. Neither A nor B

31. Technician A says that small quantities of diesel fuel are adequate to create enough cylinder pressure to rotate the crankshaft but produce very little heat. Technician B says that less air in diesels dilutes the heat of combustion and lowers average cylinder temperatures. Who is right?

- a. A only
- b. B only
- c. Both A and B
- d. Neither A nor B

32. Which of these causes more heat retention by the engine around the exhaust ports, thus transferring more heat to the cooling system?

- a. Exhaust backpressure
- b. Lower temperature thermostat
- c. Higher temperature thermostat
- d. EGR valve

33. What creates low exhaust temperatures and low cylinder temperatures, which have adverse consequences on engine life and operation?

- a. High thermostat
- b. Excess air
- c. Excess fuel

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- d. Exhaust backpressure

34. Two technicians are discussing combustion slobber. Technician A says that low piston temperatures also mean the piston has not fully expanded and will easily allow lube oil into the combustion chamber. Technician B says that the black gooey liquid that leaks from exhaust manifold joints and the exhaust pipes when engines are excessively idled is called sludge. Who is right?

- a. A only
- b. B only
- c. Both A and B
- d. Neither A nor B

35. The IDI combustion system uses fuel injected into a smaller, spherical, highly turbulent chamber that is connected to a main chamber through a narrow passageway called a(n):

- a. venturi
- b. orifice
- c. nozzle
- d. port

36. Which of the following is NOT a major characteristic of the IDI chamber?

- a. Uses pre-combustion chamber formed in the cylinder head
- b. IDI injectors use pintle-type nozzles
- c. Uses a Mexican hat piston
- d. Chamber typically holds approximately 70% of the cylinder volume

37. What happens to the coarse fuel droplets when fuel initially contacts the incandescent glow plug during start-up and then on the hot walls of the pre-chamber during regular operation?

- a. They vaporize
- b. They atomize
- c. They get mixed
- d. They boil

38. IDIs are capable of a faster top engine rpm limit due to a higher degree of \_\_\_\_\_ to produce more rapid and even mixing of air and fuel.

- a. fuel pressure
- b. heat
- c. turbulence
- d. compression

39. Once the engine is operational, the controller will cycle the plugs on and off during the \_\_\_\_\_ period.

- a. afterglow
- b. pre-glow
- c. heating
- d. warm-up

40. Which diesel engine combustion chamber design will produce the fastest coolant warm-up times?

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- a. Direct injection.
- b. Indirect injection.
- c. Two stroke.
- d. Hemispheric chamber.

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**Answer Key**

1. a
2. b
3. b
4. a
5. b
6. c
7. a
8. c
9. c
10. b
11. b
12. a
13. c
14. a
15. a
16. d
17. b
18. a
19. d
20. c
21. a
22. b
23. d
24. d



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25. c

26. a

27. b

28. b

29. b

30. b

31. a

32. a

33. b

34. a

35. a

36. c

37. a

38. c

39. a

40. b