Chapter 26

Hybrid Drive Technology

Name _____ Date _____

Instructor _____ Score _____

Objective: After studying this chapter, you will be able to identify the major parts common to hybrid gas/electric or all-electric vehicles and compare hybrid design and construction variations.

1. What two power sources does a hybrid electric vehicle (HEV) use for propulsion?

_____

_____

_____

Hybrid Vehicles

2. What does the abbreviation *HV* stand for?

_____

3. The _____ provides driving force to the wheels. _____

Hybrid Vehicle History

4. The basic engine electric-driveline principle first designed in 1898 is used today in _____. _____

5. What is a shortcoming of full electric vehicles?

_____

_____

_____

Hybrid Drive Construction

6. What happens when a hybrid comes to a stop?

_____

_____

_____

7. Describe two functions of the electric drive system.

_____

_____

_____

_____

_____

8. Name four major assemblies in a hybrid system.

_____

_____

_____

9. With most HEVs, a conventional fuel tank, fuel lines, and electronic fuel injection system feed _____ to an internal _____.

_____

_____

10. Hybrid electric circuits and HV power cables carry voltage levels as high as _____ volts ac.

_____

Types of Hybrid Vehicles

For questions 11–13, match the following terms and identifying phrases.

_____ 11. An electric motor is the only method used to apply torque to the vehicle's drive train.

_____ 12. Uses a motor-generator to initially accelerate and propel the vehicle.

_____ 13. Propelled by its internal combustion engine only.

(A) Full hybrid
(B) Mild hybrid
(C) Series hybrid

14. A parallel hybrid uses both a(n) _____ and a(n) _____ to apply mechanical torque to the drive train.

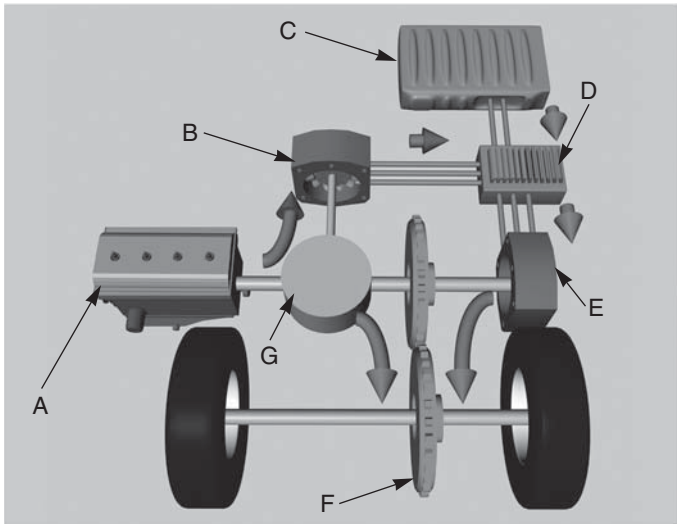
_____

_____

15. A(n) _____ hybrid can recharge the battery pack even when the electric motor is in use to drive the vehicle.

_____

16. Identify the hybrid drive components of a series-parallel hybrid.



(A) _____
(B) _____
(C) _____
(D) _____
(E) _____
(F) _____
(G) _____

Name _____

17. A hybrid designed so that the battery pack can be fully recharged when the vehicle is not being driven is known as a(n) _____. _____

18. The driving range of a full-electric vehicle is less than _____ miles. _____

19. Which type of hybrid is being raced successfully on international road race surfaces?

_____

Hybrid Vehicle Operation

For questions 20–25, match the following terms and identifying phrases.

_____ 20. Braking system that works in conjunction with the conventional hydraulic brakes.

_____ 21. Motor-generator and internal combustion engine apply torque to the drive train for propulsion.

_____ 22. When low battery voltage is detected, it starts the internal combustion engine to propel the vehicle and recharge the HV battery.

_____ 23. Motor-generator spins the engine crankshaft to start the internal combustion engine.

_____ 24. Battery pack provides all the energy needed for city driving.

_____ 25. System automatically shuts off the internal combustion engine when the vehicle comes to a full stop.

(A) All-electric drive mode
(B) Motor-assist mode
(C) Idle stop mode
(D) Regenerative braking mode
(E) Engine starting mode
(F) HV battery recharging mode

Hybrid Drive Assemblies

26. The HV battery sends high-voltage (ac, dc) _____ into the HV PCM through the HV power cables where it is converted to (dc, ac) _____. _____ _____

27. An HV battery contains several high-efficient _____ battery modules stacked in a sealed enclosure. _____

28. The HV battery is normally mounted in the _____ of the chassis. _____

29. Name two functions of a motor-generator.

_____

_____

_____

_____

30. Identify the basic parts of a motor-generator.

_____

_____

31. The armature consists of a set of permanent _____ mounted inside a segmented steel or carbon fiber disc. _____

32. The _____ is a set of stationary coil windings wrapped around iron cores and arranged around the armature. _____

33. When the motor-generator serves as a(n) _____ to propel the vehicle, three-phase voltage is applied to the stator windings by the HV PCM. _____

34. Define *power splitter*.

_____

_____

_____

35. The (converter, inverter) _____ circuit in the HV PCM can step dc voltage up or down. _____

36. The (converter, inverter) _____ circuit in the HV PCM changes dc to ac and ac to dc. _____

37. Define *hybrid control module*.

_____

_____

_____

38. What measures armature speed and position to control ac phase shift, which controls motor torque and speed?

_____

39. A hybrid ground _____ constantly monitors the system for high-voltage leakage into the metal chassis of the vehicle. _____

40. What will happen if high-voltage from the HV battery or motor-generator is shorting to ground?

_____

_____

_____

41. What happens to the battery during air bag deployment?

_____

_____

_____

42. Explain what impact sensors do.

_____

_____

_____

Name _____

43. Name three things in a combination meter.

_____

_____

_____

44. What happens to the hybrid drive ready light when the electric drive is engaged?

_____

_____

_____

45. A(n) _____ in the combination meter warns if there is _____ a problem in any part of the drive train.

46. What could make the battery pack warning light illuminate?

_____

_____

_____

_____

_____