

#### Presentations for PowerPoint

## Modern Automotive Technology



The Goodheart-Willcox Co., Inc. Tinley Park, Illinois

# Chapter

## The Automobile

#### **Objectives**

After studying this chapter, you will be able to:

- Identify and describe primary parts within major automotive systems.
- Explain the frequent electronic interaction of major automotive systems or circuits.
- Describe and compare major automobile design variations.

#### **Objectives**

- Identify and locate the most important systems used to operate conventional and hybrid passenger vehicles.
- Comprehend later textbook chapters with a minimum amount of difficulty.
- Correctly answer ASE certification test questions that require a general understanding of the major parts and systems of a vehicle.

#### The Automobile

- Automobile
  - Derived from Greek word autos, which means self, and French word mobile, which means moving
- Technology
  - Application of math, science, physics, engineering, and other subjects

#### Parts, Assemblies, and Systems

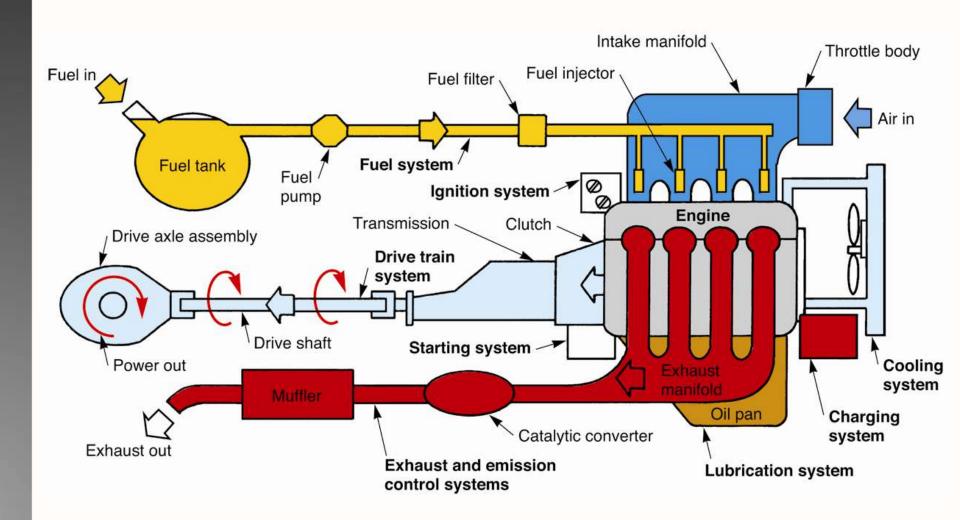
- Part or component
  - Smallest removable item on car
- Assembly
  - Set of fitted parts designed to complete specific function
- System
  - Group of related parts and assemblies that perform specific function

#### Major Vehicle Systems

- Body and frame
- Engine
- Computer systems
- Fuel system
- Electrical system
- Cooling and lubrication systems

- Exhaust and emission control systems
- Drive train systems
- Suspension, steering, and brake systems
- Accessory and safety systems

## Major Vehicle Systems (Cont.)



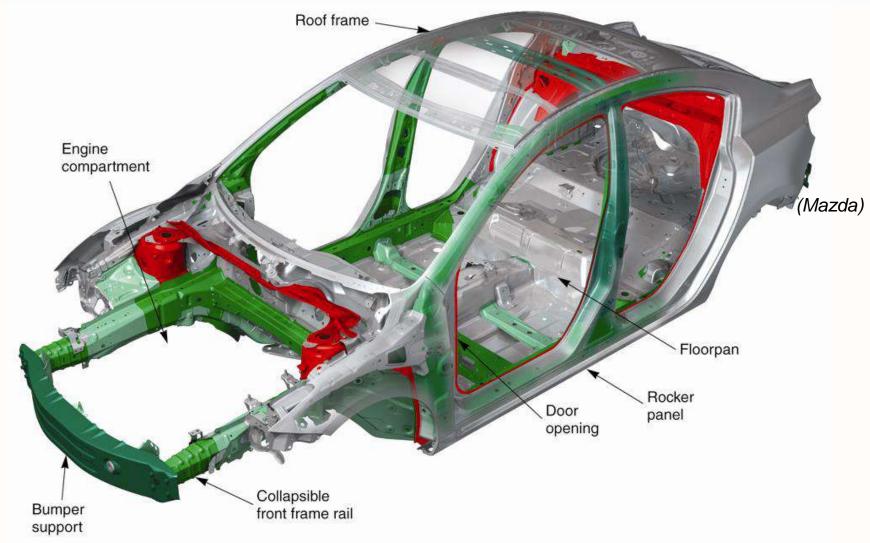
#### Frame, Body, and Chassis

- Frame
  - Metal structure, provides mounting place for all other parts
- Body
  - Skin forming outside of vehicle
- Chassis
  - Vehicle's frame and everything mounted to it
    - Exceptions

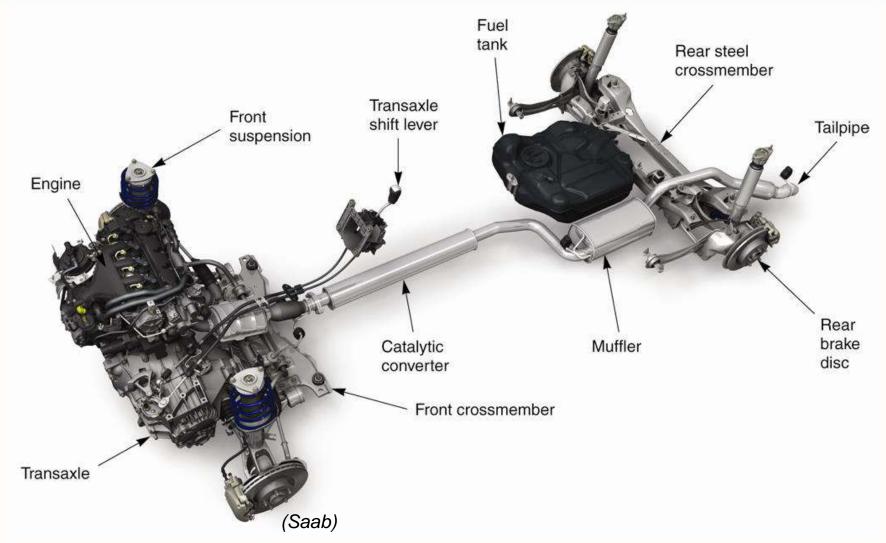
#### Frame, Body, and Chassis (Cont.)

- Body-over-frame construction (full-frame)
  - Used on vans, pickup trucks, and SUVs
- Unibody construction
  - Also called unit-body or unitized construction
    - Used on passenger cars (most common design)

#### Unibody with Chassis Removed



## Unibody Chassis



#### General Vehicle Specifications

- Vehicle curb weight
  - Total weight with full fuel tank and no driver
- Vehicle weight distribution
  - Downward force on front and rear tires
- Vehicle wheelbase
  - Distance between centerlines of front and rear wheels
- Track width
  - Distance between centerlines of two wheels on same axle

### General Vehicle Specifications (Cont.)

- Vehicle length
  - Distance between outermost point of front bumper and outermost point of rear bumper
- Vehicle width
  - Widest points from right to left sides of body perpendicular to vehicle's centerline
- Vehicle height
  - Distance from ground to highest point of roofline

#### Vehicle Sizes

- Full-size
- Midsize
- Compact
- Mini-compact





#### Vehicle Aerodynamics

- Aerodynamics
  - Study of the motion of air as it interacts with moving object
- Coefficient of drag (Cd)
  - Number that represents force required to move passenger vehicle through air

## Vehicle Body Types



Sedan



Station Wagon



Convertible



Minivan



Hatchback



Sport-Utility Vehicle

(Porshe, Honda, Audi, Subaru)

#### Fuel Efficiency

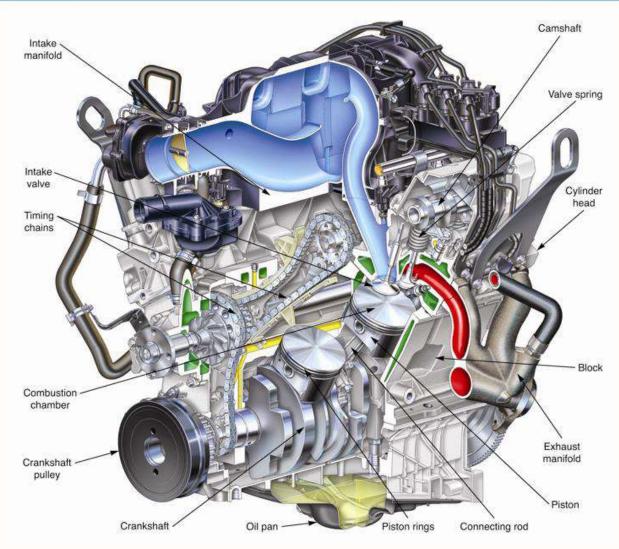
- Rating of how far vehicle can travel on only one gallon of fuel
  - Gasoline, diesel oil, or stored electrical energy
- Testing and rates
  - EPA
- Also referred to as fuel economy

#### Basic Engine Parts

- Block
- Cylinder
- Piston
- Rings
- Connecting rod
- Crankshaft
- Cylinder head

- Combustion chamber
- Valves
- Camshaft
- Valve springs
- Rocker arms
- Lifter
- Flywheel

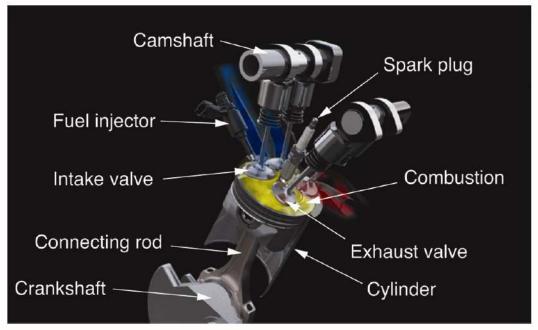
## Basic Engine Parts (Cont.)



(Ford)

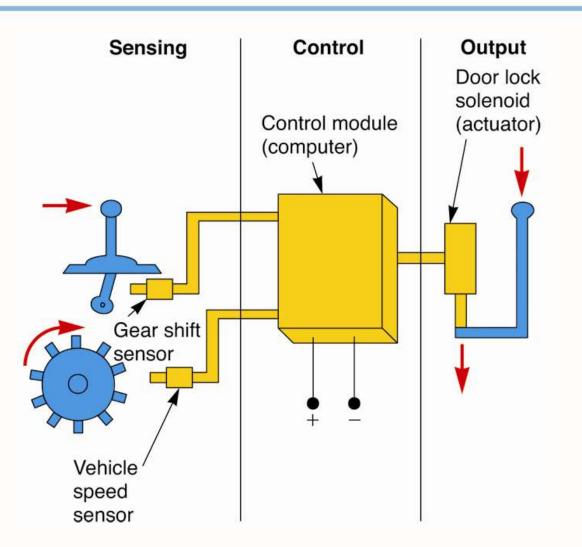
#### Automotive Internal Combustion Engines

- Normally use four-stroke cycle
  - Four piston strokes equals one cycle
- Multi-cylinder engines
  - 2-, 3-, 4-, 6-, 8-, 10-, or 12-cylinders



#### Computer System

- Sensors
- Electronic control module
- Actuators



#### Fuel System

- Introduces correct amount of fuel into system for efficient combustion
- Air-fuel ratio
  - Percentage of air to fuel
- Gasoline injection systems
  - Uses engine control module, sensors, and fuel injectors to electrically meter fuel

#### Electrical System

- Ignition system
  - High voltage surge ignites air-fuel mixture
- Starting system
  - Electric motor that rotates crankshaft until engine can run on its own power
    - Requires battery power

#### Electrical System (Cont.)

- Charging system
  - Replaces electrical energy drawn from battery
- Lighting system
  - Interior and exterior lights with associated components
    - Fuses
    - Wires
    - Switches
    - Relays

#### Cooling and Lubrication Systems

- Cooling system
  - Maintains constant engine operating temperature
- Lubrication system
  - Reduces friction and wear between internal engine parts

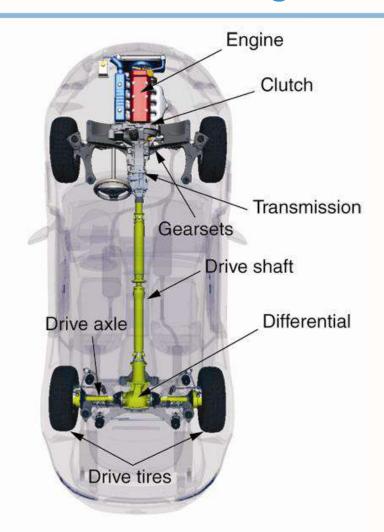
#### Exhaust and Emission Control Systems

- Exhaust system
  - Quiets noise produced by engine operation
  - Routes exhaust gases to rear of vehicle
- Emission control system
  - Reduces amount of toxic substances produced by engine and fuel system

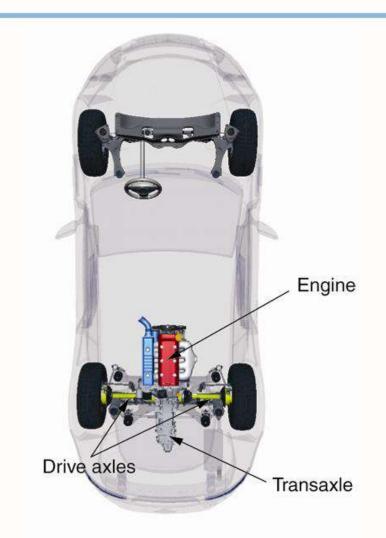
#### Drive Train Systems

- Transfers turning force from crankshaft to drive wheels
- Most common drive train configurations
  - Front-wheel drive
  - Rear-wheel drive
  - All-wheel drive

#### Drive Train Designs

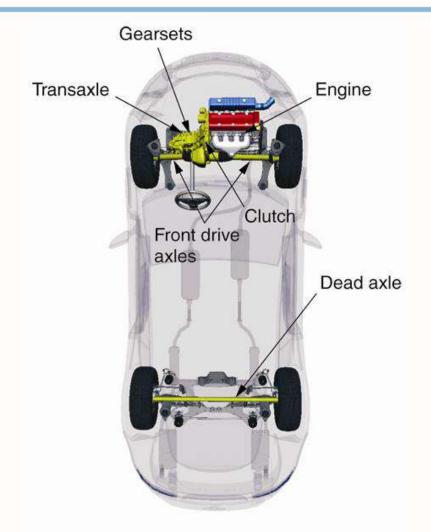


Front-Engine, Rear-Wheel Drive

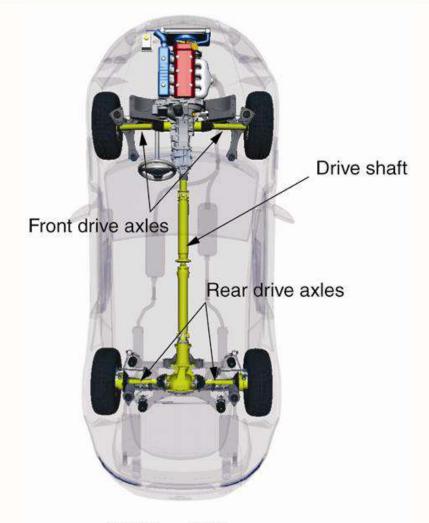


Mid-Engine, Rear-Wheel Drive

#### Drive Train Designs (Cont.)



Front-Engine, Front-Wheel Drive



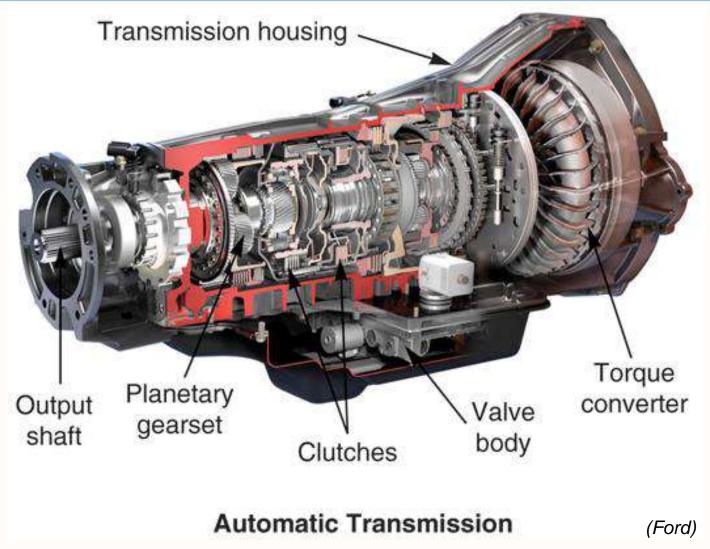
**All-Wheel Drive** 

#### **Drive Train Parts**

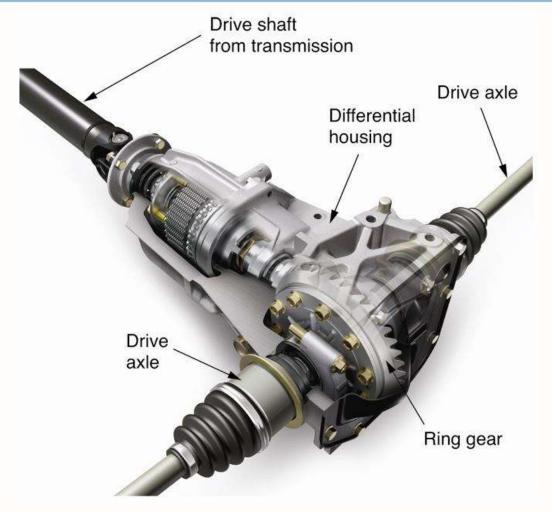
- Clutch
- Transmission
  - Manual
  - Semi-automatic
  - Automatic

- Driveshaft
- Rear axle assembly
- Transaxle
- Front drive axles

### Drive Train Parts (Cont.)



## Drive Train Parts (Cont.)



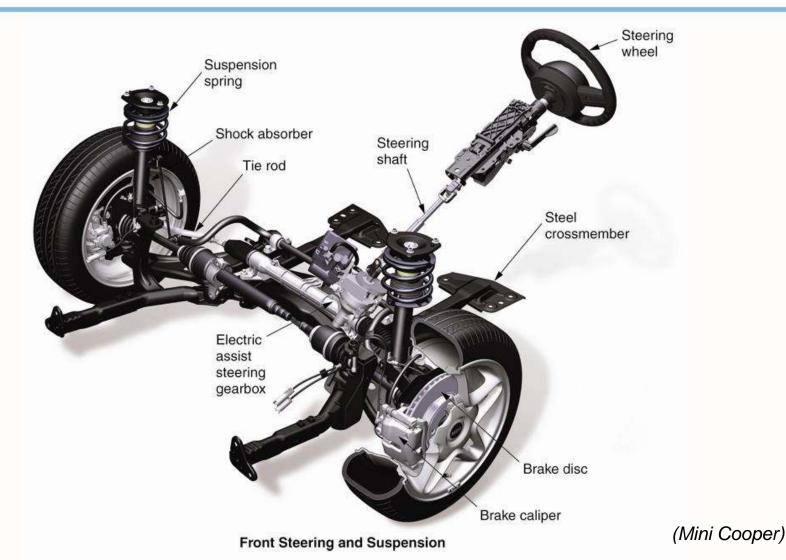
**Rear Axle Assembly** 

(Mazda)

#### Suspension, Steering, and Brake Systems

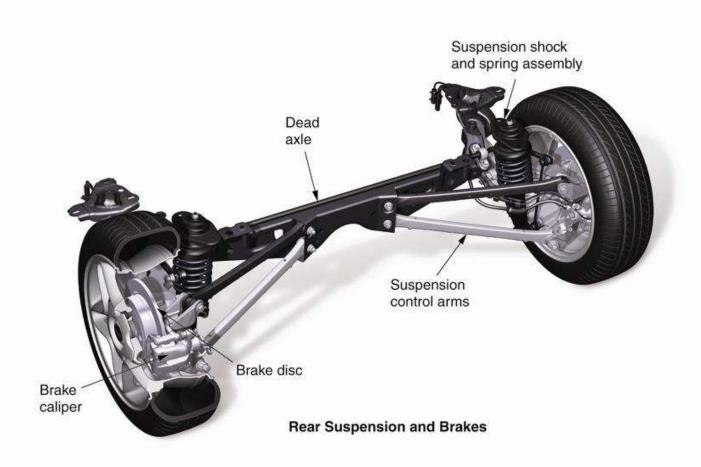
- Suspension system
  - Allows wheels and tires to move up and down with little effect on body movement
- Steering system
  - Allows driver to turn wheels left or right
- Brake system
  - Produces friction to slow or stop the vehicle

#### Suspension, Steering, and Brake Systems (Cont.)



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#### Suspension, Steering, and Brake Systems (Cont.)



(Mini Cooper)

#### Accessory and Safety Systems

- Accessory systems
  - Air conditioner
  - Sound system
  - Power seats
  - Power windows
  - Rear defogger

- Safety systems
  - Seat belts
  - Air bags
  - Security system

#### Hybrid Vehicles

- Hybrid electric vehicle (HEV)
  - Combines two methods of propulsion
    - Internal combustion engine
    - Electric drive train
- Hybrid drive train parts
  - Motor generator
  - High-voltage (HV) power cables
  - HV battery
  - HV power control module
    - All hybrids use regenerative braking