Unit Plan
SAFE Automotive (Survival Automotives For Everyone)
Fundamental Operation of Vehicles

Unit: Fundamental Operation of Vehicles        Year: 2012

Duration: 1 Week

1. List any special needs of students in your class.

In this class, there are three students that have individual educational plans (IEP). These needs mostly deal with behavioral issues, and two students have ADHD. These students need extra supervision, especially in a lab setting.

2. What are the objectives of the unit?

The objectives are for students to learn the principle of all systems of a vehicle, and how they come together to function. Students will also learn how to classify a vehicle based on the engine type, drive type, and body style of vehicle. Students will be able to demonstrate their knowledge during lab time and the quiz.

3. Why are these objectives suitable for this group of students?

This class is designed for students that are beginning drivers and are beginning to own and maintain their own vehicles. It is extremely important at this time to learn the basic operation of the vehicle that they will be driving every day.

4. How do you plan to engage students in the content?

I plan on having an open discussion during the lecture on Monday. I will encourage students to ask and answer questions. Students will also participate during demonstrations in lab, and will execute the actual lab assignment in groups.

5. What instructional resources will you use?

I will use PowerPoint as a means for lecture, and the lab and all lab equipment for demonstrations and labs. This equipment will include vehicle lifts, jacks, and wrenches.

6. What materials will be used in this unit?

Materials used will be: safety glasses, impact wrenches, personal vehicles, and owner’s manuals.

7. How do you plan to assess student achievement during this unit?

I will quiz students during their lab, before I sign off on their lab sheets. I will also hold a quiz on the last day of the unit. I will then look at the test scores to see how well the students understood the material, and go over the quiz the following week.
Chapter 1
Introduction and How Cars Work
Fuel for Thought

- How do cars work?
- What are the main systems that work together to make a car work?
Upon completion of this chapter and activities, you will be able to:

- Identify people that have impacted the development of the automobile.
- Describe how cars work and all the main systems.
Major Automotive Contributors

- Nicholas Cugnot
- Carl Benz
- Rudolf Diesel
- Henry Ford
- Dr. Ferdinand Porsche
- Many others…
Automotive Milestones

- 1876 Nikolaus Otto – 4-stroke engine
- 1886 Carl Benz – First Car
- 1903 Ford Motor Company formed
- 1908 Model T introduced
- 1937 Toyota established
- 1942–1945 U.S. automakers support Allied Powers

- 1954 Fuel Injection used on Mercedes-Benz 300SL
- 1965 Motor Vehicle Pollution Control Act passed
- 1973 Arab oil embargo
- 1997 Toyota Prius introduced in Japan
- 2007 Tire pressure monitoring system required.
How Cars Work

- Basic Engine Components
  - Engine Block
  - Crankshaft
  - Pistons
  - Connecting Rods
  - Camshaft(s)
  - Intake and Exhaust Valves
How Cars Work

- Four Stroke Engine

![Four Stroke Engine Diagram](image)

**Figure 1.5**

**Four-Stroke Spark Ignition Engine**

- **Intake Stroke:** Intake valve is open. Exhaust valve is closed. Piston moves down. Air-fuel mixture enters the combustion chamber.
- **Compression Stroke:** Intake and exhaust valves are closed. Piston moves up. Air-fuel mixture is compressed.
- **Power (Combustion) Stroke:** Intake and exhaust valves are closed. A spark plug ignites the fuel. Piston is forced down by combustion. This is the stroke that provides the power.
- **Exhaust Stroke:** Exhaust valve opens. Intake valve is closed. Piston moves up, pushing exhaust gases out of the engine.
Engine Identification

- Size/Displacement
  - Two systems of measurement
    - International System of Units (metric system)
    - U.S. customary units (English system)

Example: 1 L = 61.02 cu. in.
5.0 L = 305 cu. in.
Engine Identification

- Configuration
  - Inline
  - Opposed
  - Slant
  - V

Figure 1.8
Engine Configurations
Engine Identification

- Valve/Cam Config.
  - Overhead valve, in block cam shaft
  - In block valves, in block cam shaft
    - Flathead motors/small engines
  - Overhead valve, overhead cam
    - Dual or single cam per head
Hemi Engine

- Commonly found in Chrysler products
- Named after the hemispherical shape of the combustion chamber
Diesel Engines

- Diesel components
  - No spark plugs.
  - Glow plugs to preheat the cylinders
  - Compressed air and diesel are injected directly into the cylinder
  - Compressed air is heated, igniting the fuel
Vehicle Identification

VIN

- Vehicle Identification Number
  - 17 Characters
  - Found on driver’s doorjamb and on the top of the dashboard

![VIN Example](Mfd. by Honda of America Mfg., Inc. 11/05
GVWR 3737LBS GAWR F 1973LBS R 1764LBS
GVWR 1695KG GAWR F 895KG R 800KG
This vehicle conforms to all applicable federal motor vehicle safety, bumper, and theft prevention standards in effect on the date of manufacture shown above.
V.I.N.: 1HGFA16876L026954 Type: Passenger Car
SNE 6 AG9 -R525P -H -L)

Figure 1.9

Doorjamb VIN
Vehicle Identification

- Manufacturers
  - GM
  - DaimlerChrysler
  - Ford
  - Toyota
  - VW
  - Honda
  - Many others…
Vehicle Identification

- Makes
  - Examples
    - Ford manufacturers Ford, Lincoln, Mercury, Jaguar, Land Rover, Volvo, and Aston Martin
    - Toyota manufactures Toyota, Lexus, and Scion
Vehicle Identification

- Models
  - Examples – Make/Models
    - GMC – Sierra and Yukon
    - Lincoln – Navigator and Town Car
    - Jeep – Commander and Wrangler
Vehicle Identification

Type

- Examples
  - Microcar, Subcompact Car, Compact Car, Mid-size Car, Full-size Car, Sports Car, Mini SUV, Crossover SUV, SUV, SUT, Compact Pickup, Mid-size Pickup, Full-size Pickup, Minivan, Van
Common Fuels and Designs

- **Gasoline Powered Vehicles**
  - Pollutants
    - hydrocarbons, nitrogen oxides, carbon monoxide, and carbon dioxide

- **Diesel Powered Vehicles**
  - Pollutants
    - greenhouse gases + nitrogen oxides, sulfur dioxide, and particulate matter
The Future

Currently and Near Future
- Hybrids
- Flex Fuel E85

More Distant Future
- Fuel Cell Technology
- Photovoltaics???
The automobile has made land transportation easy.
Automobiles allow people to work great distances from where they live.
Automobiles create pollution.
New technologies are emerging.
CHAPTER 1- Introduction and How Cars Work

How Cars Work

- Basic Engine Components

Four Stroke Engine

<table>
<thead>
<tr>
<th>Four-Stroke Spark Ignition Engine</th>
<th><a href="http://www.AutoUpkeep.com">www.AutoUpkeep.com</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression Ratio commonly 8:1 to 12:1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spark Plug</th>
<th>Air-Fuel Mixture</th>
<th>Exhaust Gases</th>
</tr>
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<tbody>
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</tbody>
</table>

Figure 1.3 Dual Overhead Camshaft (DOHC) Engine

Figure 1.5 Four-Stroke Spark Ignition Engine
Engine Identification

- Size/Displacement
  - Two systems of measurement

Example: $1 \text{ L} =$ ____________  $5.0 \text{ L} =$ ____________

Engine Identification

Engine Identification-Valves and Cam Shafts

- Valve/Cam Configuration

A single overhead cam
Engine Identification-Hemi Engines

- Hemi Engine

Diesel Engines

- Diesel components

Induction | Compression | Ignition | Exhaust
Vehicle Identification

VIN  Vehicle Identification Number

Makes
- Examples
  -
  -

Models
- Examples – Make/Models
  -
  -
  -

Type
- Examples
  -
  -

Common Fuels and Designs
- Gasoline Powered Vehicles
  - Pollutants
  -
  - Diesel Powered Pollutants
  -

The Future
- Currently and Near Future
  -
  -
- More Distant Future
  -
  -
BOOK STUDY QUESTIONS
1. What was the earliest self-powered road vehicle?

2. Who was credited with the world's first motorcar?

3. How do cars work?

4. How are vehicles classified?

5. What is the difference between a manufacturer and make?

6. What does the acronym VIN represent?

7. What two units of measurement are used to classify engine sizes?

8. What is an engine configuration? List several examples.

9. What is the difference between a gasoline and diesel engine?

10. Why is it a good idea to know the size of your vehicle's engine?

ACTIVITY JOURNAL
1. When was the vehicle manufactured?

2. What company manufactured your vehicle?

3. What is your vehicle's VIN?

4. What are the make, model, and type of vehicle you investigated?

5. According to the VECI sticker, what is the model year of your vehicle?

6. What is the size, type, and configuration of your engine?

7. How many cylinders does your engine have?
Chapter 1: Intro, Vin Numbers

NAME: ____________________________

DATE_________________________

**AUTO LAB GRADING:**

1. Required specifications correct according to the manual.
2. Lab findings are accurate, have been checked
3. Lab questions answered correctly and all answers neat and legible.
4. All lab procedures have been performed and answered correctly.
5. Teachers signature on lab as required, and work is in on time

**Total ____**  
A = 30-27  B = 26-24  C = 23-21  D = 20-18  F = 17 and Below

**Directions**

1. Open the driver's door and look for the vehicle certification label.
2. Identify the date of manufacture. ________________________
3. Identify the vehicle manufacturer. _______________  Car Owner ________________________
4. Look in the front windshield and find the VIN. Write down the VIN. ________________________
5. Look on the outside of the vehicle. The make and model are usually identified on the rear, front, or side of the vehicle. Note the make and model. ________________________
6. Identify the vehicle type (e.g., subcompact, compact, mid-size, full-size, sports car, mini SUV, crossover SUV, SUV, SUT, compact pickup, mid-size pickup, full-size pickup, minivan, or van).

7. Open the hood and find the vehicle emission control information (VECI) sticker. If you are unsure how to open the hood, refer to your owner’s manual. A release latch should be under or near the steering column. Once the hood is popped, there is a safety latch on the outside.
8. Look on the VECI sticker to determine the model year. ________________________
9. Look on the VECI sticker to determine the size (e.g., 2.0 L) and type (e.g., gas or diesel) of engine in your vehicle. ________________________
10. Look at the engine to try to determine the number of cylinders. Identifying the number of spark plugs may help you. ________________________
11. Look at the engine design to determine the configuration (e.g., inline, V, slant, or opposed).
12. Close the hood.
Section 1: Selected Response

Directions: Place the letter that corresponds to the correct answer on the space provided.

___ 1. The ____________ was one of the earliest self-powered vehicles.
   a. Hummer
   b. Cugnot steam traction engine
   c. Tucker
   d. Taurus

___ 2. Most 4-cylinder engines are configured in this way.
   a. V
   b. Slant
   c. X
   d. Inline

___ 3. Automobiles became popular in the _____ century.
   a. 14th
   b. 16th
   c. 18th
   d. 20th

___ 4. The VIN is commonly located on the __________.
   a. dashboard
   b. taillight
   c. headlight
   d. wheel

___ 5. The Ford Model T is famous for being __________.
   a. the first car
   b. mass-produced
   c. hand built
   d. blue in color

___ 6. Who patented the world’s first practical motorcar?
   a. Carl Benz
   b. Henry Ford
   c. Nicholas Cugnot
   d. Ferdinand Porsche

___ 7. Which of the following can enter the bloodstream, reducing the flow of oxygen throughout the body?
   a. nitrogen
   b. particulate matter
   c. carbon dioxide
   d. carbon monoxide
Section 2: Selected Response ASE Style Questions
Directions: Place the letter that corresponds to the correct answer on the space provided.

___ 8. Technician A says that gasoline engines have spark plugs to ignite the air-fuel mixture. Technician B says that diesel engines use compression to ignite the air-fuel mixture. Who is correct?
   a. Technician A
   b. Technician B
   c. Both Technician A and Technician B
   d. Neither Technician A nor Technician B

___ 9. Technician A says that the day the vehicle comes off the assembly line is the model year. Technician B says that the model year can be located on the vehicle emission control information (VECI) sticker. Who is correct?
   a. Technician A
   b. Technician B
   c. Both Technician A and Technician B
   d. Neither Technician A nor Technician B

___ 10. Technician A says that the number of cylinders within the engine block is used to identify the engine design. Technician B says that the engine configuration is used to identify the engine design. Who is correct?
   a. Technician A
   b. Technician B
   c. Both Technician A and Technician B
   d. Neither Technician A nor Technician B

___ 11. Technician A says that engine size can be listed in liters. Technician B says that engine size can only be listed in cubic inches. Who is correct?
   a. Technician A
   b. Technician B
   c. Both Technician A and Technician B
   d. Neither Technician A nor Technician B

Section 3: Constructed Response
Directions: Use complete sentences to answer the following questions.

12. What are the four strokes in the four-stroke spark ignition engine? What occurs during each stroke?