**MEC1020**

**Vehicle SErvice and Care**

**Teacher marking Key**

This package contains the answers for the student workbook. There are a couple charts which ask the students to go into the nearest parking lot and survey the number of vehicles which are four wheel drive, have disc brakes, etc. There is no answer for those questions, but they are required to show you their results. There are also points after many of the chapters where the students are required to get you to check their bookwork and progress, initialing after you are done. This is an excellent opportunity to gauge their progress and urge them along.

The mark assignment is one mark per question. Some questions have various steps, but if there is any concern about the student grasp of the process, the next check you make would be a good time to get them to explain it to you.

# Study Questions – Answer Keys – Version 2.1

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# Chapter 1: Introduction and How Cars Work

## Study Questions

1. What was the earliest self-powered road vehicle?

**Cugnot steam traction engine in 1769-1770 was the earliest self-powered road vehicle.**

1. Who was credited with the world’s first motorcar?

**Carl Benz was credited with building the world’s first motorcar**.

1. How are vehicles classified?

**Vehicles are classified and identified by their manufacturer, make, model, year, and type.**

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

**An automotive manufacturer (example GM) is a company that produces vehicles. Automotive manufacturers identify the various vehicles they produce by their “make” (example Cadillac).**

1. What does the acronym VIN represent?

**VIN stands for Vehicle Identification Number.**

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

**Gasoline powered engines use spark plugs to ignite the air-fuel mixture in the engine. Diesel engines do not have spark plugs. Diesel engines are compression ignition engines.**

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

**Knowing the engine size will help identify the correct replacement parts (e.g., alternator) and maintenance items (e.g., filters).**

# Chapter 2: Buying an Automobile

## Study Questions

1. Why do you need an automobile?

**This answer will vary. Most answers may indicate to get from one place to another.**

1. If you worked 16 hours a week earning minimum wage, how much money would you gross per week?

**16 hours x current minimum wage = gross per week**

1. If you decide to buy an automobile and have to make payments, why is it best to shop around for interest rates?

**The interest rate that you ultimately pay can make a big difference on the overall price you pay for your vehicle.**

1. What is the difference between MSRP, Dealer Cost, and Dealer Invoice?

**MSRP is commonly called the sticker price. Few vehicles sell at MSRP. Dealer Cost is what the dealer will actually pay for the vehicle after holdbacks and incentives. In the past, Dealer Invoice was the price that car dealerships paid for their vehicles. However, most dealerships receive factory to dealer incentives and factory holdbacks.**

1. What is a reasonable offer to make on a new automobile in relation to Dealer Cost?

**It is reasonable and fair to offer 4% more than Dealer Cost.**

1. What does it mean if someone has to co-sign a loan with you?

**The co-signer will be responsible for the loan if you default.**

1. What is the difference between buying and leasing an automobile?

**When you buy a car, you own it. When you lease a car, you are “renting” it for the lease term (commonly 36 months).**

1. What are some expenses (other than the monthly payment) you will encounter in owning an automobile?

**Sales tax, fuel, maintenance, unexpected repairs, licenses, registration, and insurance are some expenses from the time of purchase and through daily use.**

1. What safety features are available on automobiles?

**Some safety features include seatbelt design, airbag design (and quantity), head restraints, antilock brakes, stability control, traction control, visibility, and tire quality.**

1. What is a *comparable* when selling an automobile?

**A comparable is an estimate of the value of a vehicle based on various factors: make, model, year, mileage, accessories, and condition. A comparable can be determined by looking at publications such as Kelly Blue Book, NADA, Edmunds, or other individuals trying to sell a similar vehicle.**

# Chapter 3: Automotive Expenses

## Study Questions

1. What are common automotive expenses?

**Monthly payment, insurance, fuel, license, registration, routine maintenance, and unexpected repairs are common expenses.**

1. What are three things that your monthly car payment is dependent on?

**Your monthly car payment is dependent on amount financed, duration of loan, and interest rate.**

1. What is the minimum insurance policy that your state requires?

**This varies from state to state. A 20/40/10 is the minimum in some states.**

1. What do the numbers 50/100/20 represent in an insurance policy?

**The first number indicates that this policy would have $50,000 bodily injury coverage per person.**

**The second number indicates that this policy would have a limit of $100,000 bodily injury coverage per accident.**

**The third number sets the property damage limit at $20,000.**

1. What does collision insurance cover?

**Collision insurance covers the cost to repair your vehicle if you were at fault in an auto accident.**

1. What does comprehensive insurance cover?

**Comprehensive insurance covers the costs to repair your vehicle for damage from things such as natural disasters, vandalism, theft, fire, or hitting an animal on the road.**

1. How much would you spend on gasoline each year if you drove 10,000 miles over the year and your vehicle achieves 15 miles per gallon with gasoline priced at $2.75 a gallon.

**10,000 miles / 15 miles per gallon = 666.67 gallons per year**

**$2.75 a gallon x 666.67 gallons per year = $1833.34 spent per year on gasoline**

1. Using the same scenario as question seven, substitute your vehicle with a hybrid-electric automobile that achieves 60 miles per gallon. Calculate the yearly cost for fuel with this vehicle.

**10,000 miles / 60 miles per gallon = 166.67 gallons per year**

**$2.75 x 166.67 gallons per year = $458.34 spent per year on gasoline**

1. How often do license plates need to be renewed in the state that you reside?

**Many states require renewal once a year or once ever other year.**

**(Answers will vary based on your state.)**

1. Why is it important to keep up with routine maintenance?

**If routine maintenance is ignored, it usually costs more money to fix as an unexpected repair and possible tow.**

# Chapter 4: Repair Facilities

## Study Questions

1. What does it mean when a technician is ASE certified?

**The technician has taken a test to demonstrate competence in a specific area. In addition to passing an exam, a technician is also required to have two years of related experience to become certified.**

1. What are AAA Approved Auto Repair facility characteristics?

**The American Automobile Association (AAA) approves auto repair facilities that meet strict standards in repair, service, and facility cleanliness. AAA Approved Auto Repair facilities also have to provide a 1 year/12,000 mile (20,000 km) repair warranty.**

1. What are examples of an ASE technician’s Code of Ethics?

**Examples include: “I will strive to produce nothing but first-class workmanship. I will take advantage of every opportunity to increase my knowledge/skills concerning the work I am doing. I will dedicate myself to lifelong learning. I will use only those materials that are proven to be safe and recommended by the manufacturer.” A complete list is found on page 29 of the text.**

1. What is the purpose of the Better Business Bureau?

**The Better Business Bureau is a neutral non-profit organization between companies and consumers to promote ethical practices. This organization works to prevent consumer and business fraud.**

1. What is the difference between an estimate and a repair invoice?

**An estimate is prepared before a repair is performed. A repair invoice summarizes the work completed.**

1. What types of warranties are available on new vehicles?

**Factory warranties include: bumper-to-bumper, powertrain, corrosion perforation, emission, safety restraint, and hybrid related components.**

1. Why might a chain warranty be better than an independent repair facility warranty?

**The benefit of a chain warranty is that it is guaranteed by any repair facility within the chain.**

1. What does it mean when a warranty is pro-rated?

**Pro-rated means that you will have to pay for part of the replacement cost, depending on how old or worn the component is that you are trying to get covered.**

# Chapter 5: Safety Around the Automobile

## Study Questions

1. Why is it important to “think safety” while working on an automobile?

**Vehicles, by their nature, are dangerous. They have moving engine parts; they are heavy; they have explosive fuels; they have high voltages when running; and they often have parts that are too hot to touch.**

1. What things should you know the location of in a garage, shop, or laboratory facility?

**Know the location of fire extinguishers, first-aid kits, eyewash stations, and a telephone.**

1. What safety equipment is required when working on vehicles?

**Personal protection equipment includes safety glasses, shoes that will protect your feet, ear protection (e.g., earmuffs or earplugs) when loud noises are present, gloves, and clothing that is not loose or baggy.**

1. Why do you need to be extremely cautious around electric fans?

**Electric fans can start without the key on.**

1. What is the procedure for jacking up a vehicle?

**Position the service jack so that it comes in contact with the frame or another solid chassis component. Chock at least one wheel still on the ground. Slowly pump the jack and start lifting the vehicle. Once at the desired height, position the jack stands under the frame or specified jacking points. Ratchet the jack stands to the desired height. Slowly lower the vehicle onto the jack stands and remove the service jack.**

1. How are fire extinguishers classified? What type of fire extinguisher should you have in an automotive shop?

**Fire extinguishers are by the type of fire they put out. A-type extinguishers put out wood, paper, cloth, rubber, plastic, and upholstery fires. B-type extinguishers put out gasoline, oil, grease, and paint fires. C-type extinguishers put out electrical fires. D-type extinguishers put out combustible metal fires. A combination A-B-C fire extinguisher is recommended in an automotive shop.**

# Chapter 6: Basic Tools

## Study Questions

1. What is the difference between an open-end and a box-end wrench? Use a drawing to illustrate the difference.

**Inspect student drawings to determine understanding. Compare to figures 6.2 and 6.3 on page 45 of the text.**

1. If a 6-point wrench is less likely to strip a fastener, when would there be a need for 12-point wrench?

**The 12-points allows for twice as many as placements on the fastener, especially beneficial in tight working spaces.**

1. What is the most common ratchet size?

**3/8” is the most common drive ratchet size.**

1. What specialty tool can be used to test voltage, resistance, and amperage in a circuit?

**A multimeter can be used to measure voltage, resistance, and amperage.**

1. What are the two types of measurement systems commonly used?

**The International System of Units (metric system) and the U.S. customary units (English system) are commonly used.**

1. What is the function of a tire pressure gauge?

**An air gauge, or tire pressure gauge, is use to measure tire pressure.**

1. What are two common types of screwdrivers? How do you know what type of screwdriver tip to use?

**The most common types of screwdrivers are Phillips and flat head. The head of a fastener determines the type and size of screwdriver that is needed.**

1. If you only had one wrench in your toolbox, what type would it be?

**An adjustable wrench is a versatile wrench to have in a toolbox.**

1. Why is it important to use the correct tool?

**Using the correct tool when working on your car will make the job easier and safer.**

# Chapter 7: Auto Care and Cleaning

## Study Questions

1. What are two types of automotive paint finishes? What is the difference?

**The two types of finishes are basecoat and clearcoat. With a basecoat finish the color is the topcoat. A clearcoat finish has a basecoat that is covered with a clearcoat.**

1. What types of weather, climatic, or road conditions affect vehicle finishes?

**Rain, snow, ice, road dirt, dust, mud, and salt can affect vehicle finishes.**

1. What is a chamois?

**It is a super absorbent drying towel that is usually made from sheepskin.**

1. Why shouldn’t you use dish detergent for washing your vehicle?

**Dish detergents are not chemically designed for vehicle finishes. They may strip the wax and dry out the finish.**

1. What is the purpose of waxing a vehicle?

**Waxing adds shine and protection to your vehicle’s finish. It coats and “moisturizes” the vehicle’s finish, removing oxidation to keep the finish shining.**

1. Why is it important to vacuum the inside of a vehicle?

**Vacuuming cleans the inside of the vehicle. Dirty fabric will wear out quicker than clean fabric.**

1. Why should you wash a vehicle before waxing it?

**Washing removes dirt and grime that may be rubbed into the paint when waxing. If dirt and grime are not removed, scratches can occur.**

1. Why should you dry a vehicle after washing?

**Water and the impurities in water can add to corrosion and wax breakdown. The quicker a vehicle dries, the better.**

# Chapter 8: Fluid Level Check

## Study Questions

1. What functions do various fluids provide to vehicle components?

**Various fluids provide cooling, cleaning, lubrication, and/or sealing.**

1. What is the process to check engine oil?

**Park the vehicle on a level surface. Shut off the engine, open the hood, and locate the engine oil dipstick. Pull out the dipstick, wipe it off with a paper towel, reinsert it completely into the tube, remove again, and note the reading. The engine oil should be in the safe range.**

1. What is the color of clean oil? What is the color of dirty oil?

**Clean engine oil is gold in color. Dirty engine oil is black in color.**

1. What is the process to check automatic transmission fluid?

**Drive the vehicle about ten minutes to warm up the transmission. Most manufacturers recommend that the engine be running and that the gear selector is in park. Apply the parking brake. Locate the automatic transmission oil dipstick. With the engine idling, pull out the dipstick, wipe it off with a paper towel, reinsert it completely into the tube, remove again, and note the reading. The fluid should be between the full cold and the full hot marks.**

1. What is the color of clean automatic transmission fluid?

**Clean automatic transmission fluid is pinkish-red.**

1. What is the process to check antifreeze (coolant) level?

**The engine must be cool. Check the level in the coolant recovery tank. Then check the level in the radiator by removing a cool radiator cap and looking into the radiator. The fluid should be at or near the top.**

1. What is a common color for windshield washer fluid?

**It is usually blue in color.**

1. What are some safety precautions when handling brake fluid?

**Brake fluid is harmful to your eyes and can damage a vehicle’s finish.**

1. What is the process to check power steering fluid?

**Shut off the engine, locate the power steering reservoir, remove the dipstick, wipe it off, reinstall, remove again, and note the reading. The stick usually has a full hot and a full cold line.**

# Chapter 9: Electrical System

## Study Questions

1. What is the purpose of the battery?

**The purpose of the battery is to store chemical energy, supply electrical energy to the starter when the engine is cranking, and supplement the alternator in running various accessories.**

1. What does a starter do?

**The starter converts electrical energy to mechanical energy to crank over the engine.**

1. How does an automotive battery get recharged?

**The charging system keeps the battery recharged by converting mechanical energy to electrical energy to chemical energy.**

1. How is the cold-cranking rating different from a cranking-rating?

**A battery that is rated with cold-cranking amps has been tested to deliver the specified number of amperes at 0 degrees Fahrenheit for a duration of 30 seconds. A battery rated with cranking amps has been tested to deliver the specified number of amperes at 32 degrees Fahrenheit for a duration of 30 seconds.**

1. Why shouldn’t you bypass a fuse?

**Severe electrical damage could result. The fuse needs to be the weak link in the circuit in order to protect all of the components.**

1. What could cause a fuse to blow?

**A fuse could blow because of a short-circuited wire, accessory pulling too much current, or wrong fuse rating.**

Chapter 10: Lubrication System

## Study Questions

1. What does oil do within an engine?

**Engine oil lubricates, cools, cleans, and seals.**

1. How does engine oil get dirty?

**Some road dust and dirt brought in with air gets by the air filter. Incomplete combustion adds carbon deposits to the oil. Water can also come in contact with the oil from humidity in the air and from gaskets leaking.**

1. What does API stand for and what does it rate?

**API stands for American Petroleum Institute. API rates the engine oil service.**

1. What does SAE stand for and what does it rate?

**SAE stands for Society of Automotive Engineers. SAE rates engine oil viscosity.**

1. Why is it not recommended to overfill the engine with oil?

**If you overfill your engine oil, you will get air bubbles. Air does not have a lubricating ability.**

1. What is one advantage and one disadvantage of synthetic oils?

**Advantages are improved fuel mileage, increased stability as temperatures fluctuate, and lubricating qualities that last for up to 25,000 miles. Disadvantages are higher cost, poor break in quality due to its high lubricating qualities, and most manufacturers still require regular oil change intervals.**

1. How often should the oil and filter be changed?

**Change every 3 months or 3,000 miles.**

1. What does an oil filter do?

**Oil filters help to clean the engine oil by collecting dirt, dust, and other contaminants.**

1. Which oil is more viscous, 5W30 or 20W50?

**Viscosity is defined as the resistance to flow. The higher the viscosity number the thicker the oil, so 20W50 is more viscous (resistant to flow).**

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# Chapter 11: Fuel System

## Study Questions

1. What is the purpose of the fuel system?

**The purpose of the fuel system is to store, transfer, and then to mix the fuel with air.**

1. What does the fuel pump do and where might it be found on an automobile?

**The fuel pump supplies the engine with fuel. Mechanical fuel pumps are usually located on the engine and electrical fuel pumps are usually located in the fuel tank.**

1. What does the acronym PCV represent?

**PCV represents positive crankcase ventilation.**

1. What does the acronym CCV represent?

**CCV represents crankcase ventilation.**

1. How often should air filters be changed?

**Change air filters every 12,000 miles or as recommended by the manufacturer.**

1. What are common octane ratings of gasoline sold at the pump?

**Common octane numbers are regular 87, mid-grade (or plus) 89, and premium 93.**

1. What is ultra-low sulfur diesel?

**Ultra-low sulfur diesel (ULSD) contains a maximum of 15 parts per-million (ppm) of sulfur, as compared to low sulfur diesel that allows up to 500 ppm of sulfur. Model year 2007 and later diesel engines require ULSD.**

1. How can you improve the fuel economy of your automobile?

**Check tire pressure, tune-up the engine, check the wheel alignment, run air conditioning only when necessary, change the oil as required, check cooling system operation, look for dragging brakes, avoid excessive idling, combine trips, moderate speed, avoid jack rabbit starts, use cruise control, remove excess weight, plan trips, fill up when it is cool outside, avoid resting foot on brake pedal, and put the transmission in overdrive are ways to improve fuel economy.**

# Chapter 12: Cooling System

## Study Questions

1. What does the cooling system do within an engine?

**The cooling system allows the engine to reach operating temperature quickly, maintain efficient operating temperature, and remove excess engine heat.**

1. What is the purpose of the radiator?

**The purpose of the radiator is to remove heat from the coolant.**

1. What is the purpose of the thermostat?

**The thermostat is the brain of the cooling system. It senses the temperature of the coolant and allows the fluid to exit to the radiator. It controls the temperature in the cooling system.**

1. Why do automobiles have coolant recovery tanks?

**The coolant recovery tank holds excess coolant during the cooling system operation. As pressure and heat build up, the coolant expands and is then transferred to the recovery tank. This allows no fluid loss during cooling system operation, while keeping the maximum amount of coolant in the system at all times. It also keeps outside air from being drawn into the engine block.**

1. Why should you mix a 50/50 blend of water and antifreeze?

**A 50/50 blend will give the coolant a freezing point of –35 degrees Fahrenheit and a boiling point of about 225 degrees Fahrenheit. This mixture carries the best properties.**

1. How do you get heat in your automobile when it is cold outside?

**Heater hoses are used to transport heated coolant to the heater core. The heater core is located on the engine compartment’s firewall. The heater fan, controlled by the operator, can blow air through the heater core providing heat inside the vehicle.**

1. How are drive belts part of the cooling system?

**Drive belts turn water pumps, mechanical fans, and air conditioning compressors.**

1. How often should antifreeze be serviced?

**Standard antifreeze should be changed every 2 years or 24,000 miles. Dex-Cool antifreeze should be changed every 5 years or 150,000 miles.**

# Chapter 13: Ignition System

## Study Questions

1. What is the purpose of the ignition system?

**The purpose of the ignition system is to step up voltage and ignite the fuel-air mixture efficiently and in a timely matter.**

1. What is the purpose of an ignition coil?

**It steps up the low voltage to the high voltage needed to ignite the air-fuel mixture.**

1. What do spark plugs do?

**The spark plug completes the high voltage circuit. Voltage at the spark plug needs to be great enough to arc across a gap thus creating a spark. This spark ignites the air-fuel mixture.**

1. How is the battery part of the ignition system?

**Electrical energy must be present to ignite the air-fuel mixture. The battery is the starting point of power (converts chemical energy to electric energy).**

1. What is an advantage of having an electronic (distributorless) ignition system?

**Tune-up intervals on the electronic (distributorless) ignition systems vary, but some manufacturer’s boast up to 100,000 miles. The electronic (distributorless) ignition system eliminates a mechanical distributor, increases voltage at the spark plug, produces a better-timed spark, and a more efficient engine.**

1. How often should spark plugs be changed?

**Spark plugs should be changed every 10,000 miles on conventional ignition systems, every 25,000 miles on distributor ignition systems, and every 50,000 to 100,000 miles on electronic ignition systems.**

1. Why do some engines use crankshaft and camshaft sensors?

**The crankshaft and camshaft sensors are used on electronic ignition systems and some recent distributor ignition systems. They keep track of piston and valve positions in the engine to efficiently time the spark. The crankshaft position sensor relays information about the crankshaft position and engine speed. The camshaft position sensor signals which coil needs to fire and sequences fuel injection timing.**

# Chapter 14: Suspension and Steering System

## Study Questions

1. What is the purpose of the suspension system?

**The suspension system helps to control the up and down movement of the vehicle. During braking or going over bumps the suspension system helps provide stability, safety, and control of the vehicle.**

1. What do shocks do?

**The shocks reduce the up and down motion that is produced from going over bumps.**

1. How are shocks different than struts?

**Struts basically eliminate the need for shocks and springs on the front and/or rear of a vehicle. They do this by integrating the shock, spring, and upper control arm into one unit, reducing the overall weight and space.**

1. What is used to reduce the effort to steer an automobile?

**A power steering pump is used to ease steering.**

1. Why is it important to torque lug nuts?

**Torque refers to getting all of the lug nuts to the same tightness. Over tightened lug nuts will make it difficult to change the tire in the future, while under tightened lug nuts may loosen up and cause the wheel to come off. In addition, unevenly tightened lug nuts can warp brake drums and rotors.**

1. How often should tires be rotated?

**Tires should be rotated every 7,500 miles or as recommended by the manufacturer.**

1. Why is it not recommended to fix a tire’s sidewall?

**The sidewall of a tire experiences too much stress from expansion and contraction as the tire rotates down the highway.**

1. What can cause a tire to wear excessively?

**Incorrect tire pressure, excessive speeds in turns, tires out of balance, suspension/steering components excessively worn, or alignment incorrect can cause a tire to wear excessively.**

# Chapter 15: Braking System

## Study Questions

1. What is the purpose of the braking system?

**The braking system is designed to decrease the speed of the vehicle.**

1. How is a disc brake system different than a drum brake system?

**The major difference between the disc brake system and drum brake system is the hardware at the wheels. The disc brake system consists of a disc, also called a rotor, and a set of brake pads that hug the rotor to create friction. The drum brake system consists of a drum with a set of brake shoes inside the drum that are forced out creating friction with the drum.**

1. What does brake fluid do?

**Brake fluid links major braking system components. It also fights corrosion, lubricates moving parts, and protects metal, plastic, and rubber components.**

1. What does the acronym ABS represent?

**ABS represents antilock brake system.**

1. What are benefits of antilock brakes?

**The ABS helps the operator maintain maximum control during hard braking.**

1. Why does the parking brake use a mechanical linkage instead of a fluid linkage?

**This allows one system to work independently of the other. If the vehicle unexpectedly loses brake fluid, the parking brake would still work.**

1. If you hear a high pitch squeal that goes away every time you apply your brakes, what might this indicate?

**Disc brake pads are most likely worn out. The squeal is from the wear indicator rubbing against the rotor.**

1. What is electronic stability control?

**Electronic stability control (ESC) has been added to many vehicles to help drivers maintain control during unstable situations such as attempting to avoid a crash or during unfavorable weather conditions. The ESC system uses information from sensors to improve the lateral stability in a vehicle by applying braking force at any wheel when instability is detected. This technology minimizes oversteer and understeer situations which ultimately helps the vehicle stay on the intended course, lessening the likelihood of skidding and rollovers.**

# Chapter 16: Drivetrains

## Study Questions

1. What is the purpose of the drivetrain system?

**The purpose of the drivetrain is to transfer power from the engine to the wheels in order to propel the vehicle.**

1. What does a drive shaft do?

**Drive shafts are designed to transfer power from the transmission to the wheels.**

1. What does a clutch do in a manual transmission?

**A clutch disc is used in conjunction with a pressure plate to shift gears. The clutch is the connection between the transmission and engine.**

1. What are four drivetrain systems (configurations)?

**Rear-wheel, front-wheel, four-wheel, and all-wheel drive are four drivetrain systems.**

1. What would be a symptom of a worn CV joint?

**A “clicking” noise noticed on a front-wheel drive car would be a symptom of a worn CV joint.**

1. How is an all-wheel drive vehicle different from a four-wheel drive vehicle?

**On all-wheel drive systems the operator doesn’t have the control to select from two-wheel drive to four-wheel drive. All-wheel drive vehicles use electronics to control the power transfer to the wheels. Speed sensors are mounted on each wheel to monitor wheel traction. When traction is lost at any one wheel, the power is transferred to another.**

1. What causes a front-wheel drive vehicle to have better traction than a rear-wheel drive vehicle?

**The weight of the engine on the front wheels gives front-wheel drive cars extremely good traction on diverse road conditions.**

1. What color is automatic transmission fluid?

**Automatic transmission fluid is a pinkish color.**

# Chapter 17: Exhaust and Emissions

## Study Questions

1. What is the purpose of the exhaust system?

**The exhaust system is designed to dampen the sound of the engine and to transport exhaust gases to the rear or side of the vehicle.**

1. What is the purpose of the emission system?

**The emission system is designed to deal with the inefficient by-products of the internal combustion process to lower the pollution of the vehicle.**

1. What do the exhaust manifolds do?

**The exhaust manifolds connect directly to the engine and are designed to harness the exhaust gasses from the numerous cylinders into one pipe.**

1. What is the purpose of the muffler?

**The muffler is used to deaden the sound from the engine.**

1. What does the acronym EGR represent and what does the EGR do?

**EGR represents exhaust gas recirculation. The EGR system reduces nitrogen oxide emissions by diluting the air-fuel mixture with the exhaust gases.**

1. What does an oxygen sensor do?

**The oxygen sensor monitors the oxygen content in the vehicle’s exhaust. It sends signals to the computer to maintain a 14.7 to 1 air to fuel ratio.**

1. What may be the problem if your vehicle is excessively loud?

**If vehicle is excessively loud there may be a hole in the muffler, hole in the exhaust pipes, or worn exhaust manifold gaskets.**

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# Chapter 19: Automotive Accessories

## Study Questions

1. What is the benefit of using floor mats?

**Floor mats help protect a vehicle’s carpet from dirt, mud, snow, salt, and other debris tracked in on feet. They can be easily removed and cleaned. If the floor mats begin to show wear, it is much less expensive to replace them than your vehicle’s carpet.**

1. When are engine heaters necessary?

**Engine heaters are a necessity in cold climates. Without one, an engine may not start. The engine heater pre-heats the engine for more efficient cold starts.**

1. When are wheel lock lug nuts commonly used?

**Wheel lock lug nuts are commonly put on vehicles with expensive alloy wheels.**

1. Why are towing mirrors sometimes necessary?

**Towing mirrors help the driver see around large trailers. They often extend out from the doors much further than standard mirrors.**

1. What is a trailer brake controller?

**The brake controller adjusts the power to the electrically operated trailer brakes during deceleration. Some trucks have brake controllers as standard equipment.**

1. How are trailer hitches classified?

**Trailer hitches are commonly classified into five classes. The style that you install depends on the vehicle. Specialty bed mount hitches are used on heavy-duty trucks to pull fifth wheel and gooseneck trailers. Refer to your owner’s manual to identify the maximum towing capacity and the correct trailer hitch.**

Class (TW lbs) (TW kg) (GTW lbs) (GTW lbs kg) Vehicle Type

I 200 91 2000 907 Mid-sized Cars Compact Trucks

II 300 136 3500 1588 Mid-sized Cars; Compact Trucks

III 600 272 6000 2722 Full-sized Cars; Mid-sized Trucks; Mid-sized SUVs

IV 1000 454 10000 4536 Full-sized Trucks Full-sized SUVs

V 1200 544 12000 5443 Full-sized Trucks Full-sized SUVs

1. Why is it important to use trailer safety chains?

**Safety chains attach to a trailer tongue to prevent runaway trailers. Safety chains hook onto the vehicle’s hitch or frame to keep the trailer connected to the vehicle if the trailer tongue slips off or breaks away from the trailer ball. A runaway trailer could cause serious injury and damage.**

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# Chapter 20: Common Problems and Roadside Emergencies

## Study Questions

1. What is OBD and how can it be helpful?

**OBD stands for on-board diagnostics. Using a scan tool, information can be retrieved to help diagnose problems.**

1. What does it mean if your car’s check engine light comes on?

**The check engine light lets the driver know if the PCM detects an emission system or engine performance problem, triggered by sensors.**

1. What does white smoke from the tailpipe usually indicate?

**White smoke indicates that the engine is burning coolant. This means that coolant is getting into the cylinders and burning with the air-fuel mixture.**

1. What might be the problem if you smell a rotten egg/sulfur odor?

**A rotten egg/sulfur smell is usually linked to a faulty catalytic converter or other component in the emission system.**

1. How can you find a leak in a tire?

**Spray the tire with soapy water. Look for a pile of bubbles. This is where the tire is leaking.**

1. What should you do if you get in a car accident?

**If you are in an accident, try to remain calm. Turn on your hazard lights. Do not leave the scene of the accident. Use a cell phone to call for assistance. If nobody is hurt and the accident was minor, move the cars (if possible) to the side of the road out of traffic. If you have safety cones, reflective triangles, or flares in an emergency kit, set them out to warn oncoming traffic. After human safety considerations have been taken, wait for police to arrive, take pictures of the accident or sketch the accident scene, and exchange information with the other party (i.e., names, addresses, phone numbers, insurance policies, driver’s license numbers, car information, and license plate numbers). Discuss the specifics of the accident only with the police. Do not accept blame or accuse the other party. Request a copy of the police report. If you believe you may have been injured, visit a doctor and contact a lawyer for advice. Finally, call your insurance company and re-read your policy.**

1. What is the proper procedure to hook up jumper cables?

**STEP 1 Connect one positive jumper cable (red) to the positive terminal (+) on the discharged/weak battery.**

**STEP 2 Connect the other positive jumper cable (red) to the positive terminal (+) of the booster/good battery.**

**STEP 3 Connect the negative jumper cable (black) to the negative terminal (–) of the booster/good battery.**

**STEP 4 Connect the other negative jumper cable (black) to a clean/bare metal part of the discharged/weak vehicle’s engine block or frame for a good ground connection.**

1. Why shouldn’t you drive your vehicle if the engine’s drive belt breaks?

**On most vehicles today, only one belt (called a serpentine belt) runs all of the engine’s vital systems and accessories. If you drive the vehicle, you risk overheating the engine. The vehicle will also not turn effectively if the power steering pump is not operational.**

1. What types of items are handy to have in an emergency roadside kit?
	* **Heavy Duty Jumper Cables**
	* **Road Flares and Reflective Triangles**
	* **Distress Flag and Sign**
	* **Disposable Gloves and Work Gloves**
	* **Fire Extinguisher**
	* **Safety Vest**
	* **First Aid Kit**
	* **Flashlight with Spare Batteries**
	* **Hand Wipes**
	* **Shop Towels**
	* **Basic Tool Kit (Screwdrivers and Pliers)**
	* **Electrical Tape and Duct Tape**