Appendix Y

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

MOBILE EQUIPMENT MAINTENANCE PATHWAY AUTO TECHNICIAN- GENERAL AUTO SERVICE UNIT 17

Auto Technician - General Auto Service

Competency (Work Tasks)	**Performance Standards** What employer checks for while doing task. **Train YA Student on.** YA student will ...	**Learning Objectives** What to know/learn to do this task. **Content Suggested** for Class/Reading/On-the-Job Training.
1. Obtain & apply basic vehicle & servicing knowledge	Demonstrate vehicle systems knowledge based on current understanding Comply with personal safety practices concerning clothing, hand and power tool usage, proper ventilation of fumes and lifting and securing of vehicles Comply with environmental safety standards concerning handling, storage and disposal of hazardous materials and chemicals in accordance with local, state and federal regulations Identify approved service procedure prior to completing any work on a vehicle Perform all procedures according to manufacturer and regulatory requirements	AUTO SYSTEMS Describe the purpose of the fundamental automotive systems and components including brake systems, electrical/electronic systems, suspension and steering systems, transmission systems, engine performance systems and heating/air conditioning (AC) systems Explain the interaction of automotive systems List and describe basic components of automotive systems Identify commonly used automotive fasteners Explain common broken fastener removal techniques Describe basic automotive engine classifications Compare gasoline and diesel engines Contrast combustion chamber designs Discuss alternative engine types Compare two- and four-stroke cycle engines HYBRIDS Identify the major parts of a hybrid drive system Explain the construction and operation of hybrid drive assemblies Describe future technology developments in hybrid motor vehicles including new cell technologies and alternative fuels Identify high-voltage circuits of electric or hybrid electric vehicle and related safety precautions MOTORS Explain the principles of an electric motor Explain the operation of solenoids MOTION Explain how friction, force, inertia, momentum, speed, power, work and torque apply to brake systems Explain the effects of weight and speed on braking and stopping distance

		FLUIDS & PRESSURE Define characteristics of liquids Identify the fundamental laws of hydraulics Define Pascal's Law Explain thermal expansion of fluids, gases, and solids Explain energy conversion of motion changed to heat energy ELECTRICITY Explain the principles of electricity Describe the action of basic electric circuits Compare voltage, current, and resistance Describe the principles of magnetism and magnetic fields Identify basic electric and electronic terms and components Describe fundamental electrical tests Identify factors that will determine how much current will flow in a circuit Discuss electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law) Identify sources of alternating current (AC)/direct current (DC) voltages and their automotive applications Identify series and parallel circuits as they apply to typical lighting circuits Describe characteristics of a series circuit Describe characteristics of a parallel circuit Describe characteristics of a series/parallel circuit Define voltage, voltage drop, current flow and resistance and their common units of measurement Explain the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.)
2. Operate tools & equipment safely	Operate only equipment that he/she is trained on Choose correct tool or equipment for the task Verify tool/equipment is available for use and in working order Verify tool/equipment is current for preventative maintenance and/or calibration Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use Operate tool/equipment safely with guarding devices if	Identify tools and their usage in automotive applications Describe how to properly and safely position a vehicle for different types of service Describe and demonstrate the safety requirements for each tool and equipment Discuss start up and shut down procedures for each tool/equipment you will operate Explain the purpose of preventative maintenance Describe emergency shutdown procedures for the

	applicable in the manner required for the job task Monitor tool/equipment for safe operation while operating Follow procedures for cleanup and shut down after use Perform any required preventative maintenance procedures Investigate and promptly report abnormal tool/equipment conditions Properly shut down and label any tool/equipment that is not operating as expected, if applicable Follow Lock Out/Tag Out procedures as applicable Document use and maintenance as required Demonstrate safe handling and use of appropriate tools Demonstrate proper cleaning, storage, and maintenance of tools and equipment Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper Utilize safe procedures for handling of tools and equipment Identify and use proper placement of floor jacks and jack stands Identify and use proper procedures for safe lift operation	tool/equipment you will operate Explain how to recognize and address malfunctions for the tool/equipment you will operate Describe how to recognize wear and tear on equipment components List the Occupational Safety and Health Administration (OSHA) and other regulatory requirements as they apply to the equipment that you operate Describe proper techniques for lifting loads List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts Explain Lock Out/Tag Out indications and procedures in your facility Identify hybrid vehicle internal combustion engine service precautions Describe the function and use of a thermometer, pyrometer, manometer Describe the function and use of an oscilloscope or GMM to diagnose engine concerns
3. Maintain work area	Identify general shop safety rules and procedures Identify marked safety areas Utilize proper ventilation procedures for working within the lab/shop area Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment Identify the location and use of eye wash stations Identify the location of the posted evacuation routes Maintain shop manuals and/or electronic retrieval systems Organize tools Sweep work area Put shop equipment away Clean work area and work bench Dispose of parts properly	Describe the typical layout and sections of an auto shop Explain the importance of proper housekeeping in the shop List the types of accidents that can occur in an auto shop Explain how to prevent auto shop accidents Describe general safety rules for the auto shop
4. Assist to process work order	Verify customer complaint (concern) ***Research information***	Identify an auto repair business' internal and external customers

	Review vehicle service history Document customer concern and complaint information on repair order Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction Prepare vehicle for service with floor mat, steering wheel cover, etc. Obtain customer signature(s) when required Handle complaints tactfully without insult or conflict	Define customer service Describe how customer service affects a company's "bottom line" List strategies to maximize customer satisfaction List the steps to follow when handling complaints
5. Research information	Locate and find resources for vehicle service information and history, service precautions, and technical service bulletins Retrieve shop manuals and/or electronic retrieval systems Locate and identify information necessary to the task	Define the purpose and use of the vehicle identification number (VIN), engine numbers, and date codes Identify references that are used to estimate vehicle repair charges Describe the different types of service manuals Explain how to use computer-based service information Discuss basic structure and information found in shop manuals, online manuals, and technical service bulletins
6. Acquire parts	Collect necessary information to determine part required Locate and interpret vehicle and component identification numbers such as make, model, year, VIN, vehicle certification labels, calibration decals Check part price Check part availability Obtain part Verify correct part upon receipt ***NOTE: Driving to get parts CANNOT be part of student's <u>regular job tasks</u> per Child Labor Laws***	Explain how to use service manuals to locate component part information Identify sources available for replacement parts List requirements of replacement parts Explain the information needed to in order to obtain the correct replacement part Describe how parts are purchased and charged to the customer Compare and contrast new, used, rebuilt and remanufactured automotive parts Describe situations in which one type of part is desirable over new parts Define original equipment manufacturer (OEM) and how this affects automotive servicing
7. Assist to diagnose common concerns & determine action	Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern ***Research information*** Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern	Explain the 3 Cs (concern, cause, correction) of automotive service Describe the basic types of troubleshooting charts found in service manuals Explain how to use the following testing instruments: Voltmeter, Test Light, Ammeter, and Ohmmeter List the most common engine performance problems Describe the symptoms for common engine performance

		problems Explain typical causes of engine performance problems Discuss common problems relating to abnormal engine noise or vibration concerns, unusual exhaust color, odor, and sound, and fuel, and ignition concerns Explain common poor stopping, pulling or dragging concerns caused by problems in the hydraulic system Explain common causes of wheel bearing noises, wheel shimmy, and vibration Discuss wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system Identify common causes of electrical circuit or component failures Discuss common problems relating to a suspension system Describe special issues related to electronically-controlled suspension systems Discuss common problems due to short and long arm suspension systems, body sway, and uneven ride height Explain common causes for steering column noises, looseness, and binding concerns Explain common problems that cause wheel/tire vibration, shimmy, and noise Describe common causes of vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns Identify the most common problems that occur in a hybrid vehicle drive system
ENGINE		
8. Perform engine oil & filter change	Obtain equipment and materials needed Review safety and service procedures Position vehicle Locate the oil drain plug on the underside of the engine Place the oil drain pan under the plug Remove the plug Let the oil drain into the pan Replace the drain plug gasket Reinstall and tighten the plug Locate the existing oil filter	Discuss common engine maintenance functions and services Explain why it is best to run the vehicle prior to changing oil Identify different types of engine oils and their purposes Explain how to determine correct oil capacity Discuss the disposal procedures for engine oil List the basic parts of a lubrication system Summarize the operation of a lubrication system Explain the characteristics and ratings of engine oil

	Position the oil pan underneath the filter to catch any remaining oil Unscrew the old oil filter Lightly coat the rubber seal of the new filter with new oil Screw the new filter into place Remove the oil filler cap on top of the engine Place the funnel in the opening and pour in the new oil Run the engine for a minute, then check the dipstick Add more oil if necessary Check the area around the oil drain plug and the filter for oil leaks Tighten the plug or oil filter if you find leakage Wipe away excess oil Dispose the used oil properly After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
9. Replace fuel filter	Obtain equipment and materials needed Review safety and service procedures Disconnect the negative battery cable Locate the fuel filter Let the pressure out of the fuel system Loosen and remove the clip near where the fuel line and filter meet Pull the fuel lines off of both ends of the filter Loosen the filter-retaining clamp Remove the fuel filter Replace it with the new filter Tighten the filter-retaining clamp Put the fuel lines back on the filter Put the clip back on the fuel line and snap it into place Tighten the fuel tank cap Connect the negative battery cable Start vehicle and check for fuel leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Summarize how crude oil is converted into gasoline, diesel fuel, liquefied petroleum gas, and other products Describe properties of gasoline and diesel fuel Explain octane and octane ratings Describe normal and abnormal combustion of gasoline and diesel fuel Define the major parts of a fuel supply system
10. Check, drain, recover, flush, refill cooling	Obtain equipment and materials needed Review safety and service procedures	List common cooling system problems and their symptoms

system	Position vehicle Allow engine to cool Place large catch pan underneath radiator drain plug Remove radiator drain plug and collect all old coolant Remove radiator fill cap to expedite draining process Remove all coolant from your radiator reservoir Inspect drained coolant as it exits the system Dispose of the coolant as required Replace the radiator drain plug Fill system with water to dilute remaining antifreeze in the engine block Replace radiator fill cap and run the engine allowing it to reach operating temperature Run engine for few minutes after engine's cooling fan turns on Shut off and cool engine Repeat draining process; collect and dispose of all waste coolant Replace radiator drain plug and refill the cooling system with distilled water only Once the cooling system has been completely filled, start the engine to allow the water to circulate Remove the radiator drain plug As the engine runs, pour fresh distilled water into the radiator fill hole at the same rate that it exits the system Continue until water being drained from the radiator appears to be clear and free of debris Stop engine and allow all remaining water to drain out Replace radiator drain plug Mix distilled water and coolant in recommended ratio Funnel fresh coolant into radiator fill hole Fill radiator at recommended rate until coolant reaches bottom of fill neck Fill the radiator reservoir to the full mark With the radiator fill cap still off, start the car and allow it to idle Continue to add coolant as air escapes the engine and cooling system Bleed air from cooling system as needed Once unable to fill the radiator any further, replace	Describe the most common causes of system leakage, overheating, and overcooling Explain the importance of antifreeze Discuss the hazards and dangers of ethylene glycol in antifreeze coolant Explain the required disposal methods for all stages of drain material Discuss the importance of cooling the engine first Explain what debris in drained coolant means Explain the purpose of the distilled water

	radiator fill cap and stop the engine After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
11. Assist to inspect engine assembly for leaks	Obtain equipment and materials needed Review safety and service procedures Start the vehicle Inspect engine for external problems such as leaks, part damage, contaminated oil Check for fuel, oil, coolant, and other types of leaks Smell fluid from leaks Listen for unusual noises Increase engine speed while listening and watching Listen carefully to abnormal engine noises using a stethoscope or other listening device Consult worksite professional to determine further tests, inspections or repairs After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe coolant in oil appearance Describe the appearance and possible causes of oil in coolant: engine oil leaks, external coolant leaks, engine blowby, engine vacuum leaks, engine exhaust leaks, and engine smoking Describe basic problem colors of exhaust smoke Describe basic problem colors of diesel exhaust smoke
12. Inspect, replace air filter	Obtain equipment and materials needed Review safety and service procedures Locate the air-filter housing Remove the screws or clamps that hold on the top of the housing Take out the old air filter Clean any dirt and debris from the housing with a clean rag Put the new air filter in Screw or clamp the lid of the air-filter housing back on After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the function and main components of a vehicles heating and ventilation system Describe the construction and action of air filters Summarize the operation and interaction of heating, ventilation, and air conditioning systems
13. Retrieve, record, interpret diagnostic codes	Obtain equipment and materials needed Review safety and service procedures Verify malfunction indicator light trouble codes using the scan tool Obtain the appropriate scan tool and program cartridge for the vehicle, system and/or date Locate the data link connector (DLC) in the vehicle	Discuss the purpose and operation of on-board diagnostic systems Explain the use of scan tools to simplify reading of trouble codes Compare on-board diagnostic (OBD) I and OBD II system capabilities and procedures Locate the data link connector on most makes and

	Attach the scan tool cable into the DLC; use an adaptor if needed Connect the scan tool to battery power if needed Follow the prompts to access the trouble codes Consult the trouble code chart or scan tool code conversion Consult worksite professional to determine further tests, inspections or repairs Erase diagnostic trouble codes when applicable	models of cars Activate on-board diagnostics and read trouble codes with and without a scan tool Describe how to use a trouble code chart in a service manual or code conversion by a scan tool Describe the importance of running all OBDII monitors for repair verification
MANUAL DRIVE TRAINS & AXLES		
14. Check for leaks & fluid conditions	Obtain equipment and materials needed Review safety and service procedures Position vehicle Check for leaks Locate and remove the transmission plug Check the oil level Check the fluid condition Reinstall the fill plug; check for leaks again After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe common causes of manual transmission leaks Explain the color, smell, and feel of manual transmission fluid Discuss the importance of fluid level Compare automatic and manual transmission components and operation
15. Check & adjust differential housing fluid level	Obtain equipment and materials needed Review safety and service procedures Position vehicle Remove the fill plug Check level of the fluid Fill housing with appropriate fluid to correct level After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain problems associated with using the wrong fluid Explain the color, smell, and feel of differential fluid Discuss the importance of fluid level Describe level of fluid when hot vs. cold
AUTOMATIC TRANSMISSION & TRANSAXLE		
16. Check fluid level in a transmission/transaxle	Obtain equipment and materials needed Review safety and service procedures Check and adjust transmission fluid Check with or without a dip-stick Locate fluid leaks Inspect for general problems with hoses, belts, and other components After servicing, verify service and make adjustments as	Describe the function and operation of the major parts of an automatic transmission Compare basic components and operation of automatic transmissions to manual transmissions Describe the operational characteristics of a hybrid vehicle drive train Describe the function and component of transmission fluid

	needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss common characteristics of transmission fluid
17. Inspect, replace, flush transmission fluid & filters	Obtain equipment and materials needed Review safety and service procedures Warm up car so transmission is at normal operating temperature ***Check transmission fluid*** Select the correct filter replacement Prepare a large pan to catch the fluid Loosen each pan bolt Finish removing the pan and any gasket material from the pan or case Inspect the pan's gasket surface for damage Remove the old filter Install new filter Inspect the drain pan for metal shavings Position gasket on pan Hand-tighten pan bolts Refill the transmission pan to "refill capacity" per vehicle specification Replace the fluid in the torque converter and oil cooler Determine total system capacity per vehicle specification Disconnect the oil cooler line from the oil cooler With another tech, be prepared to add fluid to the fill area as it is being pumped out of the oil cooler line Start the engine, and as the old fluid is pumped out, add fresh fluid to the pan When either the fluid color brightens or the total capacity has been replaced, shut the engine off and re-attach the oil cooler line Recheck the fluid level With the vehicle on level ground, idle the engine idle for a few minutes and then shift the transmission into different positions before returning to "Park" or "Neutral" Check the fluid level again and check for leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Trace the flow of power through an automatic transmission Explain how an automatic transmission shifts gears Compare the different types of automatic transmissions Compare normal versus abnormal color/odor of transmission fluid Compare automatic to manual transmission systems
BRAKES		
18. Test brake fluid for	Obtain equipment and materials needed	Discuss the look, smell, feel of brake fluid

contamination	Review safety and service procedures Position the vehicle Access the mast cylinder housing Remove the master cylinder cover Pry off the spring clip or unbolt the cover Test the fluid with a refractometer, chemical test strips, or electronic testers Report results to worksite professional Replace the master cylinder cover After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List common contaminants of brake fluid Describe problems associate with contaminated brake fluid Compare methods to test brake fluid Discuss common safety precautions for servicing brake fluids
SUSPENSION & STEERING		
19. Inspect power steering fluid level & condition	Obtain equipment and materials needed Review safety and service procedures Warm up vehicle so power steering is at normal operating temperatures Turn engine off Locate power steering reservoir Remove cap Check fluid level with dipstick or by looking at the reservoir Inspect fluid for contamination Top fluid only to correct mark After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify the function of the components of a power steering system Identify components of electrically controlled power steering systems Compare types of power steering fluid Discuss signs of low power steering fluid Describe how to determine if fluid is contaminated Explain the meaning of milky or metal contaminants in power steering fluid
20. Flush, fill, bleed power steering system	Obtain equipment and materials needed Review safety and service procedures Determine proper power steering fluid type FLUSH Position vehicle Place large container under fluid return hose Remove fluid return hose at the power steering pump with engine at idle while another tech maintains the fluid level at FULL COLD in the reservoirs using fresh power steering fluid Turn off engine Turn wheel fully to the left and right Remove pump reservoir inlet connection plug	Explain how hydraulics laws apply to power steering pump operation Explain the operating principles of steering systems Identify the role of between steering systems and handling or tire wear Describe service and repair procedures for a rack-and-pinion steering gear Explain how to complete basic power steering tests

	Install fluid return hose to pump reservoir Maintain fluid level at FULL COLD and operate engine at idle for 15 minutes Repeat and inspect fluid for contamination If contaminated repeat flush again BLEED Start the engine Turn the steering wheel fully from side to side Check the fluid level often Add fluid as needed If excessive buzzing noise is apparent repeat the bleed procedure After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
21. Inspect for power steering fluid leakage	Obtain equipment and materials needed Review safety and service procedures Inspect power steering assembly for leaks Check for overflowing, power steering pump, right type of fluid, and holes in fittings and hoses After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation Identify tire wear patterns	Discuss implications for power steering leaks from overflow, pump problems, fluid type, and loose or broken fittings and hoses Discuss power steering fluid leakage and effects on steering Discuss the function of electronically controlled steering systems (including sensors, switches, and actuators)
22. Lubricate suspension & steering systems	Obtain equipment and materials needed Review safety and service procedures Position vehicle for service Determine the type of lubricant recommended Inspect all steering and suspension joint grease seals Replace any torn or missing seals Wipe grease from each grease fitting Install plugs, install temporary fittings Apply grease to each fitting until grease begins to flow out of the bleed area or until the seal swells Apply a heavy film of grease to the steering stops on the steering knuckle and control arms Wipe excessive grease from all joints and reinstall plugs Lower vehicle After servicing, verify service and make adjustments as	Identify types of body-chassis design Identify the major parts of a suspension system Compare types of suspension systems Describe the basic function of each suspension system component Identify the role of suspension in tire wear, ride, handling, braking and acceleration force control Summarize the operation of a suspension lubrication system Locate the areas of typical joint grease seals Describe the safe and proper operation of a grease gun Compare and contrast different types of grease used for lubrication

	needed, cleanup work area, return tools to proper location, complete appropriate documentation	
23. Inspect tire condition & adjust air pressure	Obtain equipment and materials needed Review safety and service procedures Inspect the outer side wall, tread area, inner side wall Check for correct tire size and application (load and speed ratings) Check tires for bulges, splits, cracks, chunking, cupping of the tread Check for punctures, cuts, tears and other physical injuries AIR PRESSURE Remove valve stem cap Press tire gauge squarely over valve stem Read air pressure Compare reading to specification If tire pressure is low, add air If tire pressure is high, press on the valve core pin to release some air Recheck tire pressure and add or release air as needed Replace valve stem cap After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation Identify tire wear patterns	Define tire wear pattern Describe common tire wear patterns and the problems they indicate Identify the parts of a tire and wheel Describe different methods of tire construction Explain tire and wheel sizes Describe tire ratings
24. Rotate tires	Obtain equipment and materials needed Review safety and service procedures Verify tire rotation recommended by the manufacturer Position vehicle Remove right rear tire Inspect tires for wear with each tire removal Inspect brake pads for wear with each tire removal Place tire to the left front of the vehicle Remove left front tire and place to the right rear of the vehicle Re-install the tire from right rear to the left front Re-install the left front tire on the right rear Remove left rear tire and place tire to the right front of the vehicle Remove right front tire and place tire to the left rear	Explain the purpose of tire rotation Identify the recommended frequency of tire rotation List common tire, wheel, and wheel bearing problems

	Re-install tires Adjust tire pressure After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
ELECTRICAL/ELECTRONIC		
25. Verify, replace, refill wiper & washer operation	Obtain equipment and materials needed Review safety and service procedures Check wiper solution reservoir level Fill reservoir with wiper solution if needed Inspect wiper blades for cuts, splits, hardening Remove and replace wiper blades with correct size Verify operation of wiper and washer system Verify hose connection from system to hood/washers Check wiring diagram, fuses, and connections on wiper system with worksite professional if needed After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the components of a typical wiper/washer system Trace the flow of solution Discuss components of washer solutions Compare the types of pumps used in washer systems Compare types and sizes of typical wiper blades
26. Check brake lights	Obtain equipment and materials needed Review safety and service procedures With car power on and in park, press the brake pedal and have someone verify the light indicator If the light does not come on, work with worksite professional to check lamp, fuse and switch in the brake pedal After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Explain the function of a brake system List the components and operation of brake systems Compare disc and drum brake systems Describe the purpose and operation of anti-lock brakes Describe the purpose and operation of traction control and stability control systems Identify components of brake warning light system Describe the operation of a regenerative braking system. Describe the function of the brake light Explain the operation of the power and switch for the brake light Describe how to check and change brake light bulbs/lamps
27. Test, replace, aim lights	Obtain equipment and materials needed Review safety and service procedures INSPECT Test the power at the bulb socket Check the ground circuit Look for any shorted or open circuits Check for corrosion of the connector terminals	Explain the operating principles of automotive light, wiper, and horn systems Discuss the diagnostic questions to determine problems in light, wiper, and horn systems Summarize automatic light and wiper systems Explain how to aim headlights Explain both analog and digital instrumentation

	Check the fuse Check the switch REPLACE Remove the bulb assembly Remove small rings or screws Remove the lens Replace with new bulb Reinstall lens, screw, rings, and bulb assembly AIM HEADLIGHTS Use headlight aimers, aiming screen or bubble levelers according to equipment specification Adjust headlights using the vertical and horizontal adjusting screws After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify safety precautions when handling halogen bulbs Describe how to load a vehicle prior to aiming headlights Explain the purpose of the bubble level
28. Inspect, check, replace battery	Obtain equipment and materials needed Review safety and service procedures Inspect the condition of the support tray, hold-down, posts, cables and clamps Check battery, battery cables, connectors, clamps, and hold-downs TOP If the battery top is dirty, test the top of the battery with a voltmeter; if leaking voltage then clean Clean top with required solution TERMINALS Perform a battery terminal test with a voltmeter with the ignition disabled If disconnecting battery, use a memory saver to keep programmable information intact Clean battery terminals by removing the cables and cleaning with required solution Coat terminals with white grease Tighten fasteners to secure cable ELECTROLYTE LEVEL In older NON maintenance free batteries, check electrolyte level Remove vent cap	Identify safety precautions when performing battery service Describe the basic parts of an automotive battery Explain how temperature and other factors affect battery performance Describe the components of mixtures used for cleaning Explain how to clean a battery top on a NON maintenance free battery Explain how to perform a battery terminal test Discuss when to use pliers to remove battery cables Discuss precautions to take around battery fill openings Explain why only distilled water can be used in batteries Explain why over-tightening terminals is a problem Discuss how size of battery relates to motor performance and battery service life Compare battery power ratings Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery. Identify hybrid vehicle auxiliary (12 volt) battery service, repair, and test procedures.

	Check electrolyte level Fill cells to correct level with distilled water if needed REPLACE Disconnect the cables Loosen the battery hold-down Use strap to carefully lift battery out Gently place the new battery into the tray/box Check fit Tighten the hold-down Install the cables After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
29. Perform battery capacity test	Obtain equipment and materials needed Review safety and service procedures Ensure battery is charged Select the appropriate load (capacity) tester Calculate the load (capacity) rating, how much current draw should be applied to the battery Remove surface charge from the battery Connect the 2 large positive and negative clamps to the battery positive and negative terminals Connect the induction clamp around the negative tester lead if applicable Apply the calculated battery load for 15 seconds Turn off the load Compare reading to service information After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List the components and operation of a battery List common problems associated with a faulty battery Identify safety precautions when performing battery service Compare inductive and non-inductive capacity testers Explain how to calculate battery load values Describe the purpose of the battery load test
30. Perform slow/fast battery charge	Obtain equipment and materials needed Review safety and service procedures Install the battery terminal adapters if required Connect charger according to manufacturer instructions Connect the red charger lead to the positive terminal Connect the black charger lead to the negative terminal Set the charger to the appropriate current for the type of charging Turn charger on	List the components and operation of a battery List common problems associated with a faulty battery Describe how a battery charger works to charge a battery List battery charging precautions to prevent damage Compare advantages and disadvantages for slow and fast battery charging Describe the temperature and charging rates for slow and fast charging Discuss what would happen if a charger was on when it is connected to the battery

	Turn charger off when charging is complete After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	
31. Perform battery state-of-charge test	Obtain equipment and materials needed Review safety and service procedures NON-SLA On NON-SLA (sealed lead acid) batteries, perform a hydrometer state of charge test If specific gravity is at or above acceptable level, do capacity test If specific gravity for all cells is below acceptable level, charge and retest battery If specific gravity between cells varies by more than acceptable amount, replace the battery SLA Remove surface charge Perform open circuit voltage test Measure the open circuit voltage Refer to voltage chart to determine state of charge on battery After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Identify safety precautions when performing battery service Explain the operating principles of a lead-acid battery Compare conventional and maintenance-free batteries Explain how to remove surface charge from a battery Define specific gravity and how it indicates battery charge Describe how to do the hydrometer test Describe how to do the capacity test Describe how to do the open circuit voltage test Explain how to use the voltage chart to determine charge List levels which require a new battery vs. re-charging
32. Verify panel gauges & lights; rest maintenance indicators	Obtain equipment and materials needed Review safety and service procedures ***Retrieve, record, interpret diagnostic codes*** Look up trouble code chart in service manual Refer problems to worksite professional o If gauge is not functioning, assist with worksite professional to check the sending unit and replace bulbs or wiring or sending units After repairs, reset maintenance code using scan tool Verify maintenance codes are cleared and a new one was not activated After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Discuss the purpose of on board diagnostics Compare on-board diagnostics (OBD) I and II systems Describe the different types of gauges and sending units Explain how different types of gauges and sending units work Compare and contrast warning lights, sending units, switches, and basic display systems Explain both analog and digital instrumentation
33. Jump start a vehicle	Obtain equipment and materials needed Review safety and service procedures	Describe problems that can occur if jumper cables are not connected properly

	Connect one end of the red jumper cable to the positive terminal on the dead battery Connect the other end of the red jumper cable to the positive terminal of the power source or good battery Connect the other end of the black jumper cable to negative terminal of the power source or good battery Connect other end of the black jumper cable to a good ground away from the dead battery Run the engine or activate the power source while starting the vehicle with the dead battery After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	List the components and operation of jumper cables Discuss common safety precautions when using jumper cables
HEATING & A/C		
34. Replace cabin filter	Obtain equipment and materials needed Review safety and service procedures Locate the air cabin filter housing Determine if the cabin filter needs to be changed Remove the filter housing retainer clips or screws Remove the filter Gently tap the filter If dust falls from the air cleaner it is filled to capacity and needs to be replaced Remove the main access cover Undo the cover fasteners to remove cover and side cover if needed Locate and undo retainer clip to remove air cabin filter Compare the filter size to the replacement filter Reassemble the filter housing with the new filter After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	Describe the common location for air cabin filters List common reasons for clogged air filters Describe the importance of a clean air filter Identify heating and air conditioning (A/C) Components Identify the source of heating and A/C system odors
35. Inspect engine cooling & heater systems hoses, ducts, doors, filters	Obtain equipment and materials needed Review safety and service procedures Inspect hoses visually for swelling, cracks, and leaks Check for hardened hoses by hand Flex or bend the hoses, watch for surface cracks Replace hoses if problems Loosen hose clamps Twist and pull hose from fittings	Identify common components of cooling and heating systems- hoses, ducts, doors, filters, etc. Discuss common problems and wear for cooling and heating hoses Explain common problems associated with worn cooling and heating system hoses

	Clean metal hose fittings Seal fittings if corroded or pitted Slide on new hose and clamp Fit the hose clamps over the hose fittings Tighten the clamp and check for leaks After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation	