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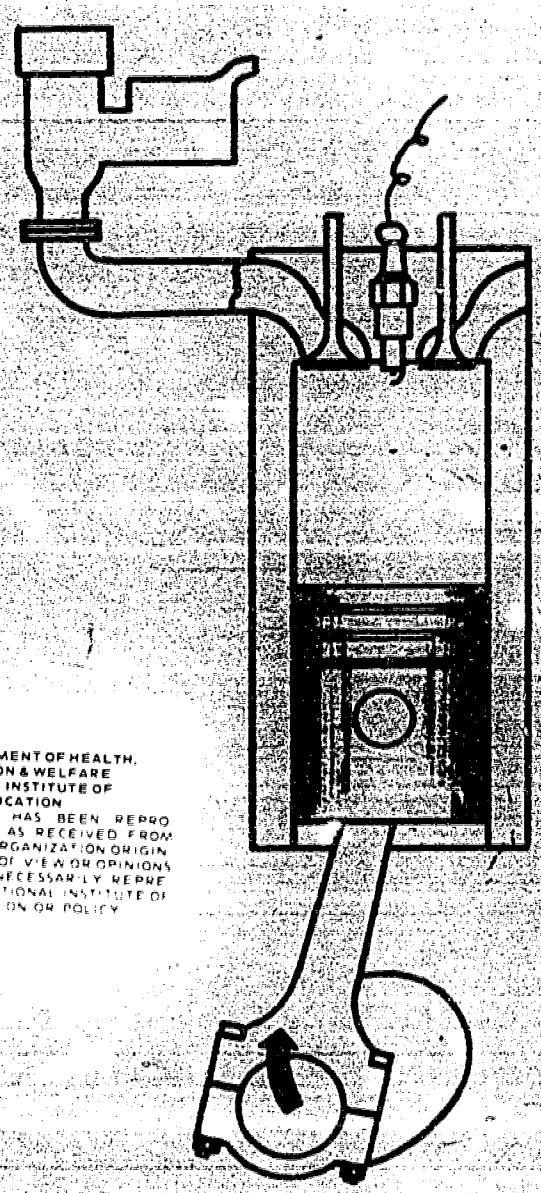
ABSTRACT

Several intermediate performance objectives and corresponding criterion measures are listed for each of 14 terminal objectives for a basic automotive mechanics course. The materials were developed for a two-semester course (2 hours daily) designed to provide training in the basic fundamentals in diagnosis and repair including cooling system and heating, electrical systems, wheels and tires, steering and suspension, brakes, engines, fuel, exhaust and emissions, and drive train. Titles of the 14 terminal objectives sections are Orientation; Safety; Hand Tools; Engine Operation; Engine Measurement and Performance; Engine Types; Engine Design; Engine Construction; Ignition and Electrical Systems; Fuel System and Carburetion; Cooling Systems; Brake System; Frames, Springs, and Suspension Systems; and Running System. (This manual and 54 others were developed for various secondary level vocational courses using the System Approach for Education (SAFE) guidelines.) (HD)

auto mechanics



PERFORMANCE OBJECTIVES

BASIC COURSE

DUVAL COUNTY SCHOOL BOARD

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Superintendent of Schools

DUVAL COUNTY SCHOOL BOARD

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Mr. Charles L. Downing

Supervisor of Vocational-Technical Education

Mr. David A. Brown

Supervisor of Industrial Education

Duval County Public Schools

November, 1974

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This manual was developed using System's Approach for Education (SAFE) guidelines.

Appreciation and recognition are extended to the following educators who have assisted in the preparation of this manual:

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Mr. Charles L. Downing, Supervisor
Vocational-Technical Education

The following educator participated as the writer of this manual:

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School Industry Education

Cover design and printing by Mr. Chester Seivert

Typist: Virginia Powell

AUTOMOTIVE MECHANICS - BASIC

Syllabus of Terminal Performance Objectives

AUTOMOTIVE MECHANICS - BASIC

Accreditation No. 9043

Length of Course: 2 semesters

Time Block: 2 hours daily

COURSE DESCRIPTION

This 360 hour course provides training in the basic fundamentals in diagnosis and repair, including: cooling system and heating, electrical, wheels and tires, steering and suspension, brakes, engines, fuel, exhaust and emissions and drive train. The course includes instruction and practical experience in the following:

A. Safety

B. Orientation

C. Care and use of hand tools and service manuals

D. Theory of internal combustion engines

E. Diagnosis, trouble shooting and repair

CURRICULUM OBJECTIVE

0.0

Design, develop and field test a three year curriculum in automotive mechanics for Duval County students by July 1975.

Although attendance, related Mathematics, Science and Communications are necessary to succeed in this field of employment and are taught as related information, it is expected that a student entering this special course will already have an adequate general education upon which this course may be presented. This will enable him to grasp and retain what is taught. A student who enters this course and does not possess the essential foundation may not expect to succeed beyond mediocre attainment.

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0 — ORIENTATION

The student will demonstrate knowledge of career opportunities in the automotive field and, other activities in transportation and student handbook by passing each criterion measure of the I.P.O.'s at its given acceptable percentage.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.1	Given a list of job titles, in the automotive field the student will select, with 100% accuracy, the titles related to automobile mechanics.	1.1	1. Circle 10 job positions in the field. a. General mechanic b. Specialty mechanic c. Shop foreman d. Service Advisor - writer e. Service manager f. Parts manager g. Vehicle salesman h. Vehicle sales manager i. Jobber salesman j. Employed by manufacturer k. Truck and bus driver l. Insurance adjuster and claims examiner m. Sales representative n. Operators of service stations or specialty repair shops o. Motor vehicle dealer
1.2	The student with 80% accuracy will answer questions about student organization available to them.	1.2	1. Name a club especially designed for the Industrial education student. 2. What does V.I.C.A. mean? 3. Who can belong to V.I.C.A.? 4. How much does it cost to join V.I.C.A.? 5. What benefits are derived from belonging to V.I.C.A.?
1.3	The student will pass with 80% accuracy, a written test on the student handbook.	1.3	1. Does this school have a dress code and does this apply to the auto shop area? 2. How many credits are received for completing this course? 3. How many hours are needed in class room before students are eligible to work in the S.I.E. program?

COURSE AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0 (cont'd) ORIENTATION

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
			4. What is the designated area for this class during a fire drill? 5. Name two reasons that a student may fail this course?
1.4	The student will with 75% accuracy pass a written test on career opportunities in the transportation field.	1.4	1. Is it necessary to belong to a union? 2. What is the average hourly pay scale? 3. What are the chances for advancement? 4. What are the determining factors for advancement?
1.5	The student will with 100% proficiency describe given positions of management in the school shop.	1.5	1. What are the duties of the safety foreman? 2. What are the duties of the shop foreman? 3. What are the duties of the toolroom foreman?
1.6	Given a print of general shop area, students will locate position of fire extinguishers on print.	1.6	Locate and mark all fire extinguishers on the shop blueprint.
1.7	Student will list six safety regulations applicable to auto mechanics shop.	1.7	Write six safety regulations applying to the automotive shop.

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0 — SAFETY

After instruction on safety practices, 80% of the students will answer 75% of the questions on a criterion examination.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		2.0	Test Attached
2.1	Given problems on good housekeeping procedures, students will orally solve 90% of the questions.	2.1	Explain and demonstrate the safe housekeeping procedures in the following situations. 1. Oily rags on floor or on test equipment. 2. Loose parts or tools on floor. 3. Oil and grease on floor. 4. Creepers, air hose extention cords or jacks in walkways.
2.2	Students will make a list of six safety hazzards in automotive shops. Examples: Horseplaying, using compressed air, throwing, unguarded fans and pulleys, open gasoline cans.	2.2	Identify six safety hazzards in the automotive shop.
2.3	Students will demonstrate the proper way to lift heavy objects with 100% accuracy.	2.3	Demonstrate the proper position for lifting heavy objects: Position of: 1. Back 2. Legs and knees 3. Hands

SAFETY - 2.0

1. WHAT MUST BE DONE WITH OILY RAGS?

2. WHICH OF THE FOLLOWNG BEST DESCRIBES GOOD HOUSEKEEPING IN THE AUTOMOTIVE SHOP?
   (a) CLEANLINESS AND NEATNESS
   (b) DISPOSAL CANS TO RECEIVE WASTE
   (c) A PLACE FOR EVERYTHING IN ITS PLACE
   (d) ALL OF THESE

3. ALWAYS CLEAN IRON FILINGS OR CHIPS BY USING COMPRESSED AIR. TRUE OR FALSE?

4. AFTER INTAKE MANIFOLD HAS BEEN REPLACED, YOU SHOULD CRANK ENGINE WITH AIR CLEANER OFF SO THAT YOU MAY PRIME ENGINE. TRUE OR FALSE?

5. THE SAFE WAY OF LIFTING A HEAVY OBJECT IS TO KEEP YOUR BACK STRAIGHT AND USE THE STRENGTH OF YOUR LEGS TO DO THE LIFTING. TRUE OR FALSE ?

6. ALWAYS USE A LIQUID EXTINGUISHER TO PUT OUT A MAGNESIUM FIRE. TRUE OR FALSE?

7. NAME FOUR JOB OPERATIONS DURING WHICH SAFETY GLASSES SHOULD BE WORN.

8. WHAT KIND OF SAFETY EQUIPMENT SHOULD ALWAYS BE WORN WHILE GRINDING A PIECE OF BRASS?
   (a) HIGH TOP SHOES
   (b) HAT
   (c) LONG SLEEVES
   (d) SAFETY SHIELDS

9. ALWAYS USE A CO_2 FIRE EXTINGUISHER TO PUT OUT A GASOLINE FIRE.
   TRUE OR FALSE ?

10. USE A LIQUID FIRE EXTINGUISHER TO PUT OUT AN ELECTRICAL FIRE. TRUE OR FALSE ?

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0 HAND TOOLS

The student will demonstrate knowledge and safety developed in the purpose and use of given hand tools, service manuals and parts catalogues as evidenced by 85% of the students achieving 75% or more on each I.P.O. criterion measure.

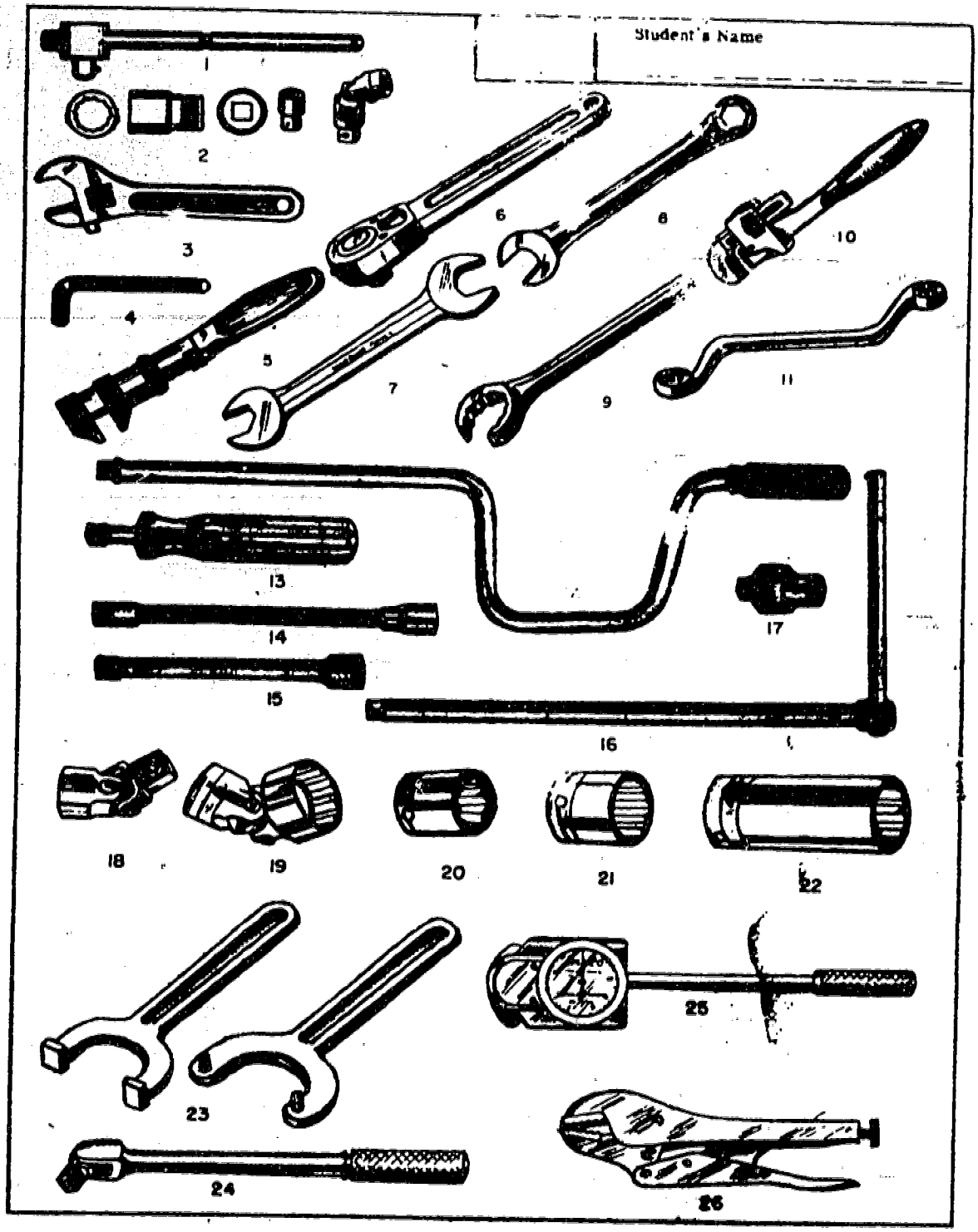
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		3.0	Test attached
3.1	Given ten incomplete sentences concerning hand tools, the student will select the correct words to complete the ten sentences with 80% accuracy.	3.1	1. The _____ is the proper tool used to determine the outside diameter of an item for out-of round condition. a. Scale b. Inside caliper c. Micrometer 2. Using a 6" scale the distance across the top of a cylinder is 4-1/2". This is called the _____. a. Torque b. Bore c. Stroke 3. The end of a Phillips type screwdriver is _____. a. Fluted end b. Flat blade c. Pointed end with 4 grooves 4. A tool inserted in a hexagon shaped recess of a screw is _____. a. Inside caliper b. Allen wrench c. Inside micrometer 5. A screw extractor has _____. a. Tapered left hand threads b. Tapered right hand threads 6. The main reason for using a box type wrench is _____. a. Used on round nuts b. Greater strength c. Less chance to slip from nuts 7. The usual cutting lip angle of a twist drill is _____. a. 75 degrees c. 59 degrees b. 60 degrees d. 45 degrees

COURSE AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0 (cont'd)

HAND TOOLS

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		3.1	8. Hacksaw blades are made of _____ a. stainless steel. b. high grade tool steel. c. cast iron. 9. A _____ is used to cut internal threads. a. die b. tap c. set screw 10. After cutting a section of tubing, it should be reamed to remove all _____ from cutting edge. a. grooves b. burrs c. lip


Student's Name
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Student name _____ Date _____

1. On the next page you will see pictures of wrenches, each of which has a small number next to it. Look at the picture, and place the number on this sheet next to the proper name for that wrench.

( )	Universal Joint	( )	Vice-grip Wrench
( )	Square Sockets	( )	Speed Tee
( )	Extension Bar	( )	Combination Wrench
( )	Open End Wrench	( )	Sliding T Handle
( )	Double Hexagon Sockets	( )	Ratchet Handle
( )	Speeder	( )	Flare Nut Wrench
( )	Double Offset Box Wrench	( )	Spinner Handle
( )	Set Screw Wrench	( )	Ratchet Adapter
( )	Socket Wrench Set	( )	Pipe Wrench
( )	Flex-Sockets	( )	Flex-Extension
( )	Monkey Wrench	( )	Spanner Wrenches
( )	Adjustable End Wrench	( )	Flex Handle
( )	Torque Wrench	( )	Deep Double Hexagon

2. Place the number, or numbers, of the tools on the blanks after the statement which best describes their use and purpose.

(1) When a socket, box or end wrench cannot be used _____ .

(2) In a hollow set screw _____.

(3) In tightening nuts to a specified tension _____.

(4) When a particularly tight grip is required _____.

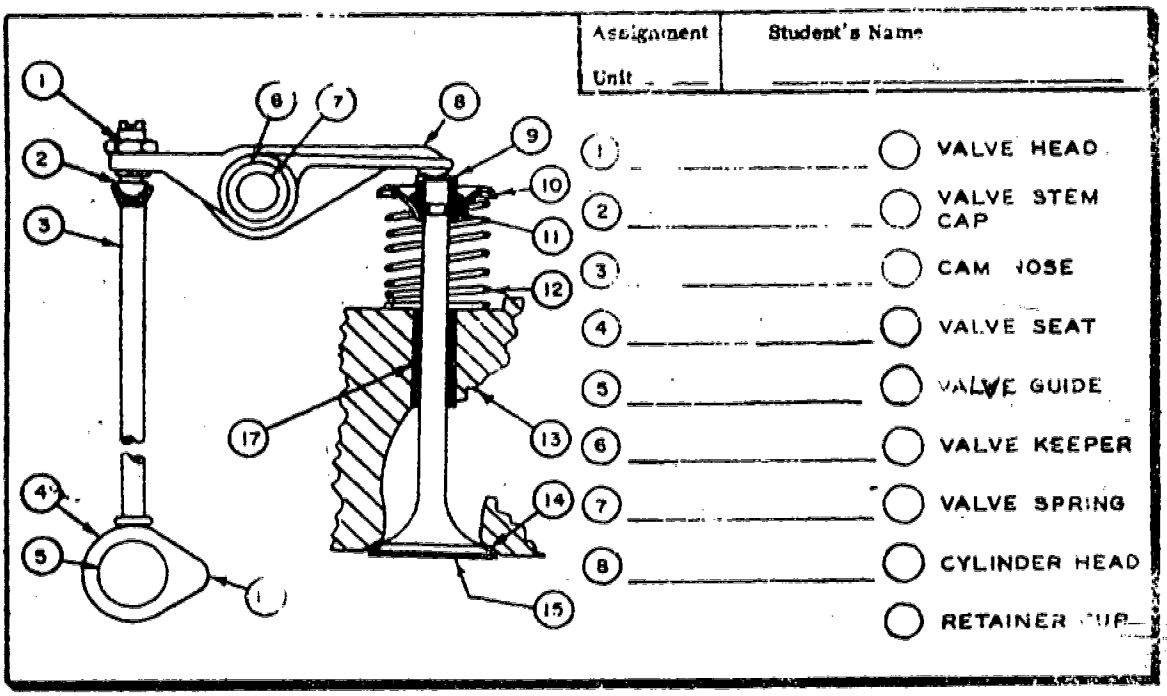
ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE
OBJECTIVE NO. 4.0 ENGINE OPERATION

The student will describe what takes place inside of an internal combustion engine that results in the production of power. He will describe the construction of a typical internal combustion engine. 75% of the students will demonstrate this knowledge by satisfactorily completing a criterion examination.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		4.0	Test Attached
.1	Given appropriate equipment, the student will remove, recondition and replace the valves in one cylinder of a 4 cycle engine. He must complete all tasks to meet factory specifications.	4.1	Reface, reseat and grind valves in one cylinder by using factory service manual.
.2	The learner will define a valve according to the following: a valve is a device created or omitting passage of gases actuated by a mechanical device.	4.2	Define a valve.
.3	The learner will describe what happens when a valve is not working.	4.3	Describe what happens when a valve is not working in an internal combustion engine.
.4	The learner will describe how to make a worn valve functional.	4.4	Describe how to make a worn valve functional.
.5	The learner will identify the angle of most popular valves for internal combustion engines. 30 45 50 75 80 100 All are in degrees.	4.5	Circle most commonly used valve as per factory manual.



ASSIGNMENT

A ◆ Study the drawing of the valve in head assembly.

B ◆ Identify parts numbered 1 through 8 by naming the parts in the space provided for each one.

C ◆ Insert the number in the encircled space next to the name of the part to which it corresponds.

RELATED PROBLEMS

1. When the engine is being warmed up, do all units of the valve assembly expand at the same rate? Explain. _____

2. Why must the end of the rocker arm, contacting the valve stem, have a rounded surface? _____

3. Will a bent or worn push rod increase or decrease the lift of a valve? _____

COURSE AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

ENGINE MEASUREMENT & PERFORMANCE

Upon completion of this unit the learner will recognize the items that have direct relationship to horsepower and effiency. 75% of the learners will with 75% or better pass an examination on the above.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		5.0	Examination attached
5.1	The learner will define the following terms: bore stroke, top dead center and bottom dead center.	5.1	Define: 1. Bore 2. Stroke 3. T.D.C. 4. B.D.C.
5.2	The learner will in writing, with 100% accuracy explain the type of friction present in an internal combustion engine.	5.2	Explain the type friction present in an internal combustion engine.
5.3	Given a list of various make internal combustion engines the learner will use a given Motors Manual and record the bore and stroke measurements of these engines with 100% accuracy.	5.3	List the bore and stroke of the following engines as per Motors Manual. 1. Chevrolet 283 C.I.D. 2. Ford 390 C.I.D. 3. Plymouth 383 C.I.D. 4. Cadillac 472 C.I.D.

ENGINE MEASUREMENTS AND

PERFORMANCE

5.0

1. A horse power is
   (a) 33,000 foot-pounds
   (b) 33,000 pound-feet per minute
   (c) 33,000 foot-pounds per minute

2. The characteristic of all material objects that causes them to resist any change of speed or direction is called
   (a) friction
   (b) inertia
   (c) power

3. The size of an engine cylinder is referred to in terms of
   (a) bore and stroke
   (b) ratio and stroke
   (c) bore and displacement

4. The horsepower actually developed inside the engine cylinders is called
   (a) brake horsepower
   (b) indicated horsepower
   (c) friction horsepower

5. What is the piston displacement in a 3-inch cylinder with a 4-inch stroke?
   (a) 28.27 cubic inches
   (b) 37.7 cubic inches
   (c) 12 cubic inches

6. The difference between the amount of air-fuel mixture that actually enters the cylinder and the amount that could enter under ideal conditions is called the
   (a) compression ratio
   (b) volumetric ratio
   (c) volumetric efficiency

7. Volumetric efficiency is greatest at
   (a) high speed
   (b) intermediate speed
   (c) low speed

8. The comparison between the engine power developed and the energy in the fuel is called
   (a) volumetric efficiency
   (b) thermal efficiency
   (c) mechanical efficiency

9. The three classes of friction are
   (a) dry, viscous, and wet
   (b) dry, greasy, and viscous
   (c) dry, viscous, and damp

CONT.

0. The term used to refer to the tendency of liquids to resist flowing is
   (a) greasiness
   (b) viscosity
   (c) velocity

COURSE AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

ENGINE TYPES

Upon completion of this unit the learner will identify the classification of engines by number of cylinders, arrangement of cylinders, type of cooling, number of cycles and type of fuel burned. 80% of the students will answer at least 70% of the questions in a written examination.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		6.0	Test attached
6.1	The learner will draw a diagram of a 4 cycle engine and write an explanation of each stroke with 80% accuracy.	6.1	Draw a diagram of a 4 stroke cycle engine and explain each stroke.
6.2	Given 4 specific engines the student will list the valve angle for both exhaust and intake valve with 80% accuracy.	6.2	List valve angles for intake and exhaust on the engines listed below. 327 C.I.D. 383 C.I.D. 390 C.I.D. 462 C.I.D.
6.3	The student will define the terms "intake and exhaust valve" with 80% accuracy.	6.3	Define the following: A. Intake valve B. Exhaust valve

ENGINE TYPES

6.0

1. Name two cars that have air-cooled engines.

2. Name the most popular rotory engine.

3. The three most common cylinder arrangements on American engines are
   (a) V-4, V-6, and V-8
   (b) flat, V, and in-line
   (c) flat four, flat six, and V-8

4. The three V-type engines described in the book are
   (a) V-4, flat-6, and V-8
   (b) flat-4, flat-6, and V-8
   (c) V-4, V-6, and V-8

5. In the Wankel engine, the rotor has
   (a) two lobes
   (b) four lobes
   (c) three lobes

6. Advantages of the V-type engine are that more even distribution of air-fuel mixture is possible and also that the engine
   (a) is shorter and more rigid
   (b) is shorter and higher
   (c) can be tilted from the vertical for a lower hood line

7. In the four-cycle engine, the four strokes are
   (a) intake, ignition, power and exhaust
   (b) intake, transfer, power and exhaust
   (c) intake, compression, power and exhaust

8. Which engine has the most number of parts?
   (a) Wankel engine
   (b) Regular American automobile engine

9. Name one two cycle automobile engine.

10. Name one automobile engine that uses diesel fuel.

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOBILE MECHANICS (BASIC)

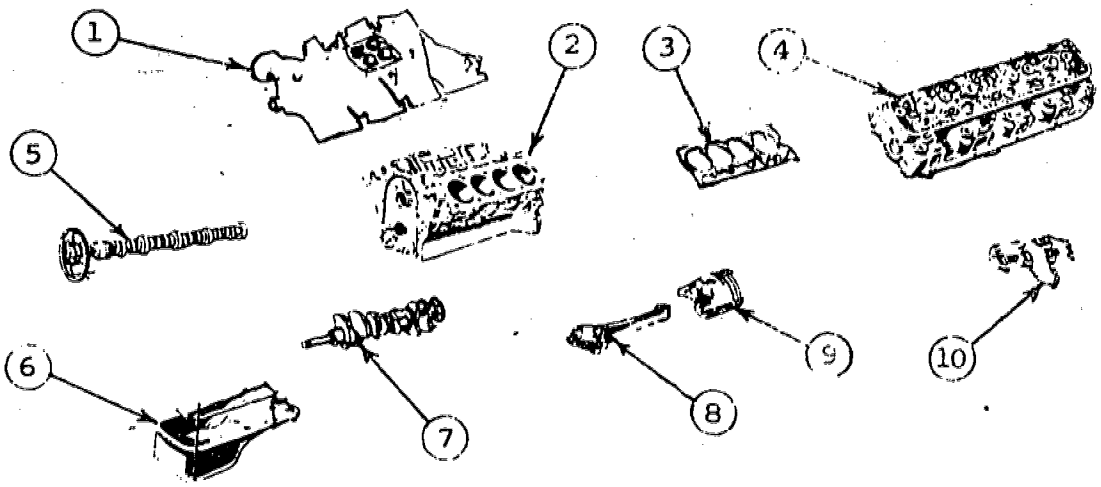
TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

ENGINE CONSTRUCTION (DESIGN)

Upon completion of this instructional unit 85% of the learners will score 80% or more on a criterion examination covering engine design and construction.

	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		7.0	Examination attached
1	The student will demonstrate a knowledge of how many and what kind of engine blocks are used in automobiles by naming and describing in writing five (5) types of engine blocks.	7.1	Name and describe five (5) types of automobile engine blocks.
2	The learner will identify ten (10) out of twelve (12) listed parts in a given diagram of an engine block.	7.2	Identify components in the engine block using attached test.

Below is a picture of parts of a reciprocating (piston) type engine with the parts numbered. Place the part number in front of the correct identifying name below. There may be extra identifying names.



Identifying Names

_____ Crankshaft	_____ Cylinder Head
_____ Distributor Shaft	_____ Oil Pan
_____ Cylinder Block	_____ Piston
_____ Exhaust Manifold	_____ Intake Manifold
_____ Camshaft	_____ Connecting Rod
_____ Water Pump Gasket	_____ Head Gasket

Name_____ Date_____

7.0 Engine Construction-Block, Crankshaft, and Bearings

Select the one best answer to each question. Mark the letter indicating the answer in the space provided to the left of the number of the question.

_____ 1. A major difference between L-head and I-head engines is that in the I-head engine.
(a) the valves are in the block
(b) the valves are in the head
(c) there are two banks of cylinders

_____ 2. In aluminum cylinder blocks, cylinder sleeves (bore liners) are used which are made of
(a) aluminum alloy
(b) bearing material
(c) cast iron steel

_____ 3. A major difference between liquid-cooled and air-cooled engines is that the cylinders in the liquid-cooled engine are surrounded by water jackets. Also they are cast
(a) separately, as in the Corvair
(b) in a block
(c) as single cylinders

_____ 4. The crankshaft is hung by bearings and caps, from the bottom of the
(a) oil pan
(b) cylinder block
(c) cylinder head

_____ 5. On most engines, the crankshaft is located in the
(a) cylinder block
(b) cylinder head
(c) crankcase

_____ 6. On I-head engines, the intake and exhaust manifolds are attached to the
(a) oil pan
(b) cylinder block
(c) cylinder head

_____ 7. On flat, or pancake, engines there
(a) is one cylinder head
(b) are the same number of heads as cylinders
(c) are two cylinder heads

_____ 8. The joint between the head and the block is sealed by
(a) machining mating surfaces smooth
(b) gaskets
(c) sealing compound

___ 9. On V-type engines, the manifold between the two banks of cylinders is the
(a) exhaust manifold.
(b) V-type engine has no manifold there.
(c) intake manifold.

___ 10. On most I-head engines, the cylinder head must carry the spark plugs as well as the valve operating mechanism and the
(a) valves.
(b) camshaft.
(c) drive chains or gears.

___ 11. On V-type engines, there
(a) is one exhaust manifold.
(b) are two exhaust manifold.
(c) is a unitized exhaust manifold.

___ 12. The carburetor mounts on the
(a) exhaust manifold.
(b) cylinder head.
(c) intake manifold.

___ 13. The front end of the crankshaft carries three devices, the drive gear or sprocket, the fan-belt pulley, and the
(a) flywheel.
(b) vibration damper.
(c) connecting rods.

___ 14. The flywheel has a ring gear with which the cranking motor drive gear meshes for cranking, and its rear face is the driving member of the clutch (where used). But the most important job of the flywheel is to
(a) aid in crankshaft balance.
(b) act as a vibration damper.
(c) smooth out power.

___ 15. The purpose of the vibration damper is to
(a) prevent crankshaft from twisting.
(b) damp out power strokes.
(c) damp out torsional vibration.

___ 16. On most engines, main and connecting rod big end bearings are of the
(a) bushing type.
(b) split-sleeve type.
(c) ball-bearing type.

___ 17. Oil circulating through the bearing oil clearances not only lubricates and helps to cool the bearings, it also
(a) tends to flush out dirt from bearings.
(b) helps to increase oil clearance.
(c) flows through the crankshaft oil passages to the oil pump.

18. Of the six bearing requirements listed in the book (load-carrying capacity, fatigue resistance, embedability, conformability, corrosion resistance, and wear rate), the two that are improved by soft bearing material are
(a) wear rate and load-carrying capacity.
(b) fatigue resistance and corrosion resistance.
(c) embedability and conformability.

19. The property of a bearing which allows its material to flow slightly away from areas of high loading to areas of low loading is called
(a) fatigue resistance.
(b) conformability.
(c) load resistance.

20. That property of a bearing which allows it to absorb dirty particles and thus reduce the possibility of scratching the shaft journals is called
(a) fatigue resistance.
(b) embedability.
(c) oil clearance.

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0 ENGINE CONSTRUCTION

Upon completion of the engine unit of instruction 90% of the students will answer 80% of attached criterion test correctly.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		8.0	Test Attached
8.1	The student will differentiate between the several methods of attaching the connecting rod to the piston (full floating, locking type, fixed type) and will identify piston and connecting rod components on a given diagram.	8.1	From attached sheet identify proper nomenclature of parts listed and answer questions.
8.2	Given a print out of events that take place in a four stroke cycle engine, the student will describe each stroke and relate parts with 90% accuracy.	8.2	Name the parts and describe what takes place on each stroke of a four stroke cycle engine on attached diagram.
8.3	Given a problem of sketching each event in a four stroke cycle engine, the student will correctly locate the parts in their relationship to each other.	8.3	Sketch and locate parts as they relate to each other in a four cycle engine.

Student's Name

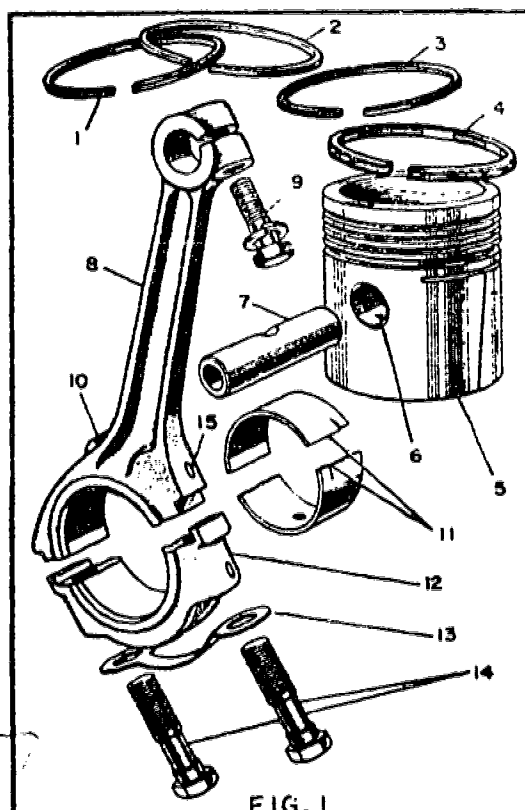


FIG. 1

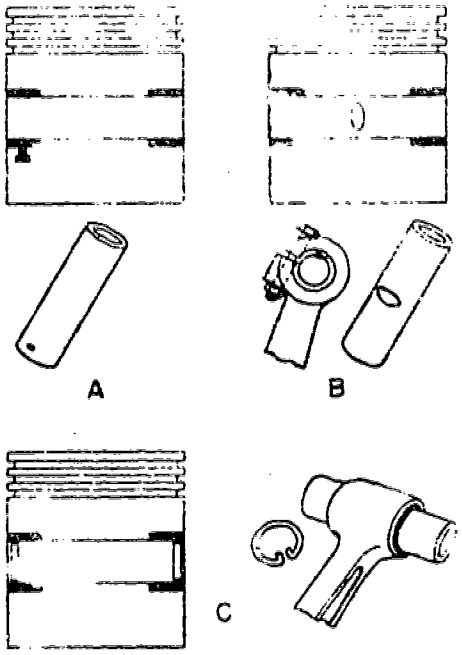


FIG. 2

ASSIGNMENT

A ➧ **Label the components indicated by number 1 to 15 in Figure 1.**

B ➧ **Identify the types of piston-pin locking in Figure 2 by inserting the letter in the space next to the name to which it corresponds.**

1. ( ) Full-floating pin 2. ( ) Fixed pin 3. ( ) Semifloating pin

RELATED PROBLEMS

1. **What is the main reason for locking the piston pin in the connecting rod or piston?** _____

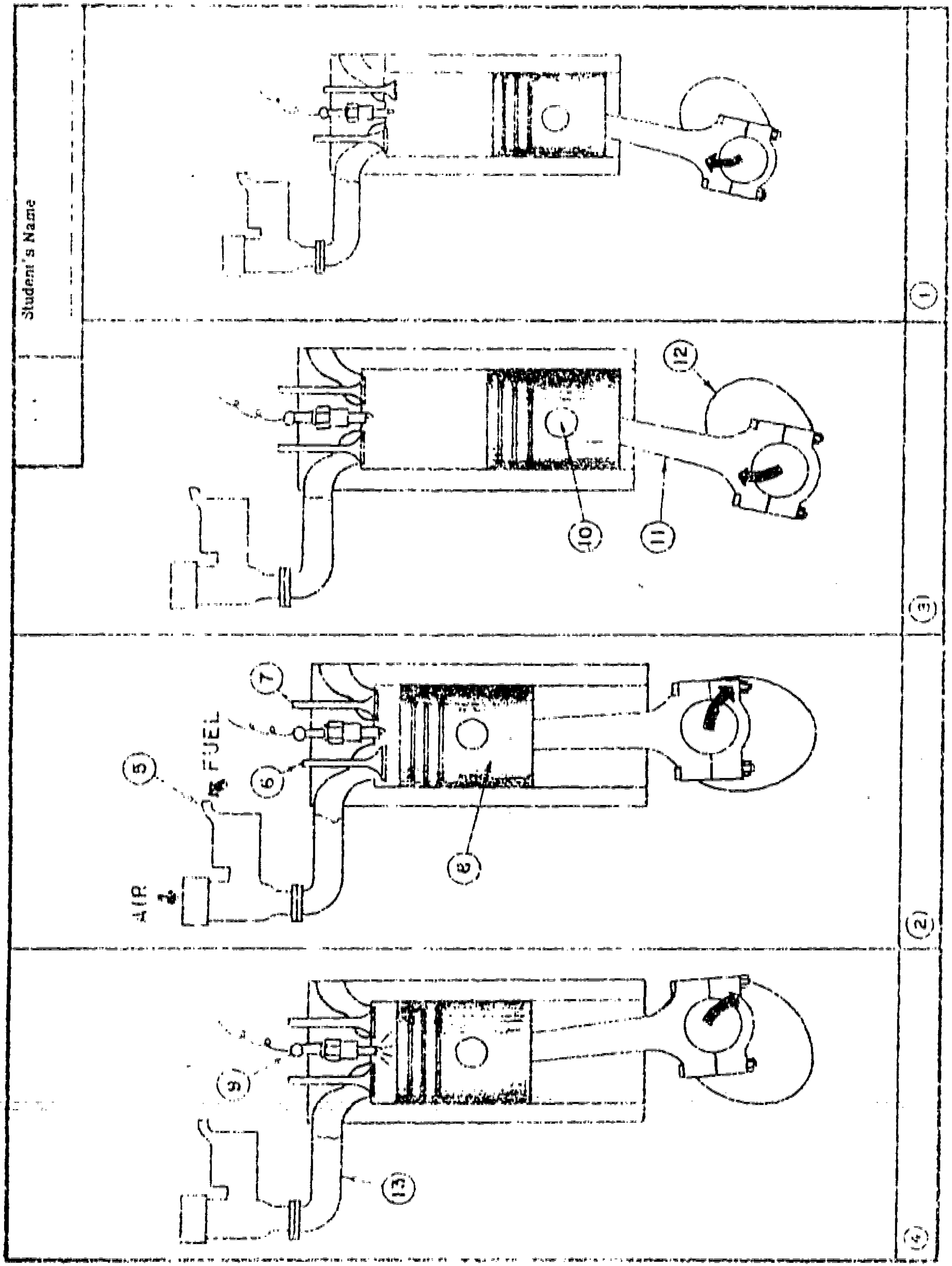
2. **Describe briefly the three types of piston-pin locks as shown in Figure 2.**

   a. _____

   b. _____

   c. _____

8.2



ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE
OBJECTIVE NO. 9.0 — IGNITION AND ELECTRICAL SYSTEMS

Upon completion of this unit the students will identify and trouble shoot starting system components on given tests and assignments. Successful completion of this objective will be evidenced by 80% of the students performing the criterion measures of the I.P.O.'s at 75% or better and answering the criterion test with 75% accuracy.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		9.0	Test attached.
1	The student will correctly identify a dead cell in a battery when testing with test equipment.	9.1	Find the dead cell in a given battery with meter and hydrometer.
2	The student will troubleshoot a faulty cranking motor by finding a shorted armature.	9.2	Test for shorted armature and u[illegible] meter and growler on assigned cranking motor.
3	The student will disassemble and repair a given dragging cranking motor, by replacing worn bushings and brushes,	9.3	Disassemble starter motor, test for short and wear and replace worn bushings and brushes on starter assigned to you.
4	The student will diagnose and trouble shoot a skipping engine. Replace defective parts using the oscilloscope, olt amp tester and ohmmeter.	9.4	Troubleshoot and repair skipping engine assigned you with test equipment. Repair according to factory, specifications.
5	The student will correctly identify and trace the path of the primary ignition system on a schematic drawing.	9.5	On the schematic drawing, trace the travel of primary ignition system in pencil.

ELECTRIC-SYSTEM SERVICE--THE STARTING SYSTEM

9.0

Select the one best answer to each question. Mark the letter indicating this answer in the space provided to the left of the number of the question.

_____ 1. As a safety precaution, and to neutralize spilled battery electrolyte, the battery man should keep on hand a quantity of
(a) distilled water
(b) baking soda

_____ 2. The test now recommended by many battery manufacturers, instead of the specific gravity test, is the
(a) high-pressure test
(b) hydrometer test
(c) light-load test

_____ 3. If, during the light-load test, all cells read 1.95 volts are above and the difference between cells is no more than 0.5 volt, the battery
(a) is in good condition but needs recharging
(b) is in good condition
(c) should be recharged and rechecked

_____ 4. A typical test specification for the high-discharge test of a 12-volt battery calls for applying a 200-ampere load, with the battery voltage falling
(a) to 6 volts after 10 seconds
(b) not lower than 9.5 volts after 15 seconds
(c) not lower than 11.1 volts after 30 seconds

_____ 5. Specific gravity of battery electrolyte goes up with
(a) increased state of charge
(b) higher temperature
(c) higher discharge rate

_____ 6. Fully charged batteries in good condition may have specific gravities between
(a) 1.280 and 1.320
(b) 1.200 and 1.250
(c) 1.225 and 1.300

_____ 7. If a battery requires a considerable amount of water in all cells, chances are it
(a) has a cracked case
(b) is in a sulfated condition
(c) is being overcharged

_____ 8. A major precaution to observe when using a quick charger is to
(a) make sure charging rate is adjusted high enough
(b) prevent battery overheating
(c) conclude charging cycle with a final high-amperage "shot"

_____ 9. When removing a battery from a car, first
(a) disconnect the insulated terminal cable
(b) loosen the battery hold-downs
(c) disconnect the grounded terminal cable

_____10. The two major battery-charging methods are
(a) constant current and constant voltage
(b) quick charge and constant voltage
(c) trickle charge and constant current

_____11. The two test to be made on a cranking motor off the car are
(a) constant current and torque
(b) no-load and torque
(c) no-load and free speed

_____12. When checking a cranking motor on the tester, low free speed and a high current draw with low torque may result from
(a) open field, open armature, or high internal resistance
(b) grounded armature, weak brush springs, or shorted fields
(c) internal ground, shorted armature, or worn bearings

_____13. When checking a cranking motor on the tester, failure to operate with no current draw may result from
(a) open or grounded fields, shorted armature, or worn bearings
(b) open field or armature, weak brush springs, or worn brushes
(c) low commutator mica, grounded armature, or worn bearings

_____14. When checking a cranking motor on the tester, failure to operate with a high current draw may result from
(a) open or shorted field, high commutator mica, weak brush springs
(b) jammed engine bearings, piston or rings stuck, grounded armature
(c) internal ground, frozen motor bearings, grounded armature

_____15. The most common cause of thrown armature windings is
(a) overheating of armature
(b) grounding of armature
(c) overspeeding of armature

_____16. Burned commutator bars usually indicate
(a) shorted armature windings
(b) open armature windings
(c) grounded armature windings

_____17. The growler checks the armature for
(a) short circuits
(b) grounds
(c) open circuits

_____18. If the over-running clutch has lost its lubricant, it should be
(a) relubricated
(b) rebuilt
(c) thrown away

_____19. High charging alternator will cause
(a) fast lost of battery acid
(b) burn out starter

_____20. What happen's to the alternator when using jumper cables wrong?
(a) shorts out commutator
(b) burns out diodes
(c) increase efficiency

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE
OBJECTIVE NO. 10.0 FUEL SYSTEM AND CARBURETION

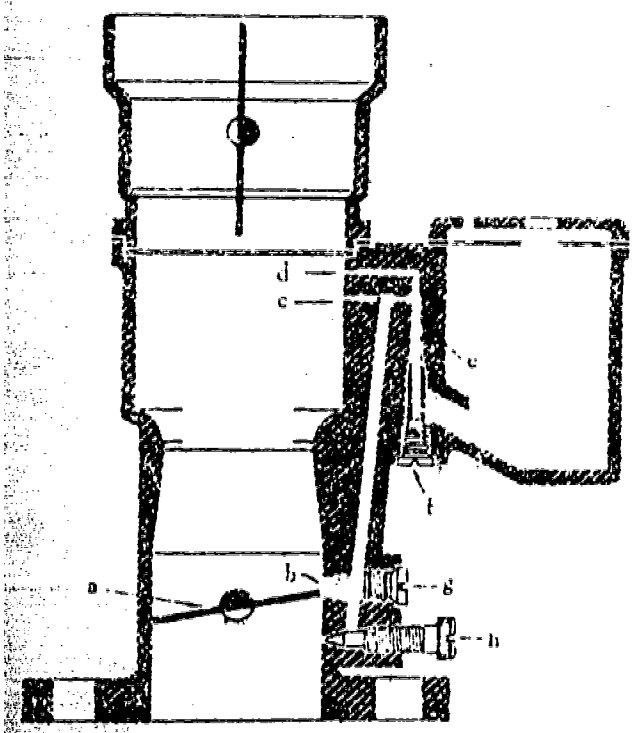
Upon completion of this unit, the student will identify, analize components and apply troubleshooting techniques to the fuel system in basic service. 80% of the students will answer 75% of the questions on a written examination and perform at the 75% level on T.P.O. assignments as measured by attached rating scale.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		10.0	Test attached
).1	The student will correctly identify components of a carburetor using a given diagram.	10.1	Name the carburetor parts on the attached drawing.
).2	Given a carburetor chart and the necessary tools the learner will correctly disassemble and reassemble the carburetor.	10.2	Disassemble and reassemble a two barrel carburetor with the aid of hand tools and a wall chart.
).3	The students will correctly demonstrate operation of the carburetor by attaching to a laboratory engine and cranking.	10.3	Shop test carburetor on laboratory engine.
).4	Given a list of four answers the student will correctly answer the multiple choice question concerning the exhaust emission control system.	10.4	Correctly answer questions on attached test.

10.1 CARBURETOR CONSTRUCTION AND DESIGN

In the following illustrations of carburetors, individual parts or circuits are designated by a letter. Write in the blank space to the right of each name listed the letter which identifies that part or circuit in the illustration.*

MATCHING TEST A



Throttle valve	1.	_____
Bypass	2.	_____
Idle passage plug	3.	_____
Port opening	4.	_____
Economizer	5.	_____
Air bleed	6.	_____
Idle adjusting screw	7.	_____
Low speed jet	8.	_____

*Illustrations in this test are reproduced by permission of Carter Carburetor Corporation, St. Louis, Missouri.

10.4

Place an "X" in front of the one explanation that best explains a "modified engine exhaust emission control system" used on automotive power plants.

_____ A. Better engine combustion is improved by changing the engine's basic design. Changes such as heated air intake, lean fuel mixtures at idle and deceleration, special ignition timing controls and a special design camshaft all help in more complete fuel combustion and a clean atmosphere.

_____ B. Because of poor burning of the fuel mixture in the combustion chamber, there are many unburnt gases (hydrocarbons) that come out of the exhaust pipe. These unburnt gases are reburned by pumping fresh air (oxygen) into the engine exhaust ports which is needed to burn these gases completely.

_____ C. Fumes and vapors collect in the crankcase because of combustion "blow-by" past the piston rings; these harmful gases are routed to the carburetor to be burned in the engine instead of being blown out of the crankcase into the atmosphere to cause air pollution.

_____ D. Many gasoline vapors escape from the automobile when operating or parked. To stop these vapors from polluting the atmosphere, automobiles now have sealed fuel systems. Gas tank evaporation is prevented by a special vented gas tank and the vapors from the carburetor are caught in a special carbon canister.

10.0 FUEL-SYSTEM SERVICE

Select the one best answer to each question. Mark the letter indicating this answer in the space provided to the left of the number of the question.

1. If the high speed nozzle is discharging gasoline wit.. the engine idling, chances are the
   (a) carburetor is functiong normally
   (b) float level is too high
   (c) choke valve is jammed open

2. If the engine runs roughly through the idling-to-25-mph range, chances are
   (a) the low speed circuit is not functioning properly
   (b) the high speed circuit is not functioning properly
   (c) the idle circuit is not functioning properly

3. When the throttle is opened suddenly, the accelerator pump circuit should continue to discharge gasoline
   (a) until the throttle is more than half open
   (b) until the throttle is released
   (c) for a few moments after throttle movement stops

4. With a normally operating carburetor, when the air horn is partly covered by hand with the engine operating at about 25 mph, the engine should
   (a) slow down
   (b) speed up
   (c) engine races

5. If the engine does not operate properly when the test in the previous question is made, chances are the trouble in the
   (a) choke circuit
   (b) high speed circuit
   (c) idle circuit

6. In normal operation, the air cleaner should be removed so that the filter element can be washed every
   (a) chassis lubrication
   (b) 10,000 miles
   (c) engine oil change

7. To clean the paper air-cleaner element,
   (a) wash it in kerosene
   (b) use compressed air
   (c) wash it in light engine oil

8. In normal service, a new paper element whould be installed in the air cleaner each
   (a) engine oil change
   (b) 10,000 miles
   (c) 30,000 miles

____ 9. To clean the polyurethane air-cleaner element,
(a) wash it in acetone
(b) wash it in kerosene
(c) use compressed air

____ 10. Before installing the polyurethane air-cleaner element,
(a) make sure it is dry
(b) dip it in engine oil and shake out excess
(c) dip it in engine oil and squeeze out excess

____ 11. Causes of insufficient fuel delivery from the fuel pump include
(a) a cracked diaphram and excessive spring pressure
(b) a cracked diaphram and sticking pump valve
(c) an excessive bearing clearance and worn pump rotor

____ 12. A high carburetor float level, worn jets, or a rich idle mixture can cause
(a) loss of power of high speed
(b) excessive fuel consumption
(c) engine stalling after high-speed driving

____ 13. Lack of high-speed engine performance could be caused by a
(a) stuck power piston, clogged nozzle, or low float level
(b) choke valve jammed open, clogged, nozzle, high float level
(c) worn nozzle, air leaks into manifold, high pump pressure

____ 14. A smoky, black exhaust is most likely due to
(a) excessive oil consumption
(b) worn piston rings
(c) excessively rich air-fuel mixture

____ 15. Failure of the engine to start unless primed is probably caused by trouble in the
(a) ignition or lubricating system
(b) engine
(c) carburetor

____ 16. One cause of engine stalls during warm-up is
(a) choke valve not closing
(b) choke valve not opening
(c) power valve not opening

____ 17. Typical carburetor adjustments that can be made on the car include
(a) idle speed and high speed
(b) pump pressure and choke
(c) idle mixture and throttle linkage

____ 18. The proper way to clean out carburetor jet and circuits is with

18 Con't.
(a) solvent and compressed air
(b) wires and compressed air
(c) drills and solvent

19. When servicing the carburetor,
(a) oil the automatic choke
(b) do not oil the automatic choke
(c) replace the automatic choke

20. The antiknock rating value of a gasoline is indicated
(a) vapor pressure
(b) evaporation rate
(c) octane number
(d) sulfur content

COURSE AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

COOLING SYSTEM

Upon completion of this unit, the student will idnetify compounds, diagnose trouble, clean, flush, refill and test cooling systems. 80% of the students must answer 75% of the questions.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		11.0	Test attached
11.1	The student will demonstrate his understanding of the purpose of the automobile cooling system orally or in writing with 80% accuracy.	11.1	Correctly state purpose of the automobile cooling system.
11.2	The student will demonstrate his knowledge of two types of engine cooling systems orally or in writing explain the function of each unit with 80% accuracy.	11.2	Describe the two different type cooling systems and explain the function of each.
11.3	Given a 180° thermostat the student will test to within limits of + or - five degrees.	11.3	Test 180° thermostat.

11.0 COOLING-SYSTEM SERVICE

Select the one best answer to each question. Mark the letter indicating the answer in the space provided to the left of the number of the question.

_____ 1. Some manufactures state that the pressure-type radiator cap should be removed only
(a) when the engine is hot
(b) if the engine fails to warm
(c) when the engine is cold

_____ 2. Some manufactures state that the only time the water level in the cooling system needs checking is
(a) after high-speed driving
(b) if the engine overheats
(c) after the engine cools

_____ 3. The cooling system thermostat can be checked
(a) in the engine
(b) by measuring the engine temperature when hot
(c) in a pan of water

_____ 4. If leaks exist at any point between the radiator and the water pump,
(a) combustion gas will enter the cooling system
(b) air will enter the cooling system
(c) water will leak from the cooling system

_____ 5. Exhaust gas leakage into the cooling system is caused by
(a) a leaky water pump
(b) loose hose clamps
(c) a defective head gasket

_____ 6. Exhaust gases in the cooling system cause
(a) leaky water pump
(b) corrosion in the cooling system
(c) a high water level in the cooling system

_____ 7. Checking for exhaust gas leakage into the cooling system requires
(a) removal of the thermostat and cylinder head
(b) removal of the thermostat and fan belt
(c) a pressure tester

_____ 8. If air is sucked into the cooling system,
(a) the water will foam and overflow
(b) corrosion will result
(c) the cylinder head gasket should be replaced

9. When using the cooling system pressure tester, apply a pressure of
   (a) 5 psi
   (b) 150 psi
   (c) 15 psi

10. If the needle of the pressure tester fluctuates with the engine running at half throttle, chances are there is
   (a) an air leak into the cooling system
   (b) a cracked engine block
   (c) a defective head gasket

11. About the only condition in the cooling system that could cause slow engine warm-up is a
   (a) thermostat stuck closed
   (b) thermostat stuck open
   (c) water pump that is partly inoperative

12. The most common cooling-system conditions that could cause engine overheating, aside from loss of water, is a
   (a) thermostat stuck open or a loose fan belt
   (b) relief valve stuck or a pressure cap loose
   (c) loose fan belt or rust

13. Other causes of engine overheating which have nothing to do with conditions in the cooling system include
   (a) high altitude, low speed, or wrong ignition timing
   (b) low altitude, high humidity, or wrong ignition timing
   (c) insufficient water, rich mixture, or low speed

14. If the engine radiator freezes, boiling the cooling system
   (a) cannot occur
   (b) can occur
   (c) sometimes occurs

15. Two systems of flushing the radiator are
   (a) pressure flushing and vacuum flushing
   (b) pressure flushing and reverse flushing
   (c) straight flushing and reverse flushing

16. Most water pumps have
   (a) ball bearings requiring periodic lubrication
   (b) sealed ball bearings requiring no lubrication
   (c) relief valves requiring periodic replacement

_____ 17. Most cooling system have
(a) air cooled engine
(b) liquid cooled engine
(c) freon cooled engines

_____ 18. Pressure cooling system
(a) lowers boiling point
(b) raises boiling point

_____ 19. When the engine is cold, the thermostat is
(a) 1/8" open
(b) completely open
(c) half open
(d) completely closed

_____ 20. Most of the heat in the cooling system is dissapated into the:
(a) water
(b) oil
(c) air
(d) all of the above

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 12.0

BRAKE SYSTEM

Upon completion of this unit, the student will diagnose repair and replace given components of the brake system service as per manufacturers specification. 80% of the students will answer 75% of the questions on a criterion examination and perform 75% of the assigned tasks in the I.P.O.'s as judged by attached rating scale.

INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
	12.0	Test attached.
Given an automobile, the students will correctly remove the assigned brake drum, repair the brake assembly for wear, damage and leaks. Shoes must be measured to factory specifications plus or minus .002.	12.1	Repair given brake assembly.
The student will correctly identify, repair, or replace defective parts causing brakes to grab and pull to one side with 100% accuracy.	12.2	Repair and/or correct pulling brakes on assigned vehicle.
The student will correctly turn the inside of a given brake drum to .080 overside plus or minus .002 according to factory specifications.	12.3	Turn assigned brake drum to .080 oversize plus of minus .002.
The student will correctly hone a given leaking wheel cylinder until all scars and pits are removed not to exceed .005 oversize on a 1-1/4" diameter.	12.4	Hone wheel cylinder. Do not exceed .005 oversize on a 1-1/4" diameter.

AUTOMOTIVE MECHANICS

PRACTICAL DEMONSTRATION RATING SCALE

ITEMS TO BE RATED	PERCENT VALUE ASSIGNED
1. Planning	15%
a. Operation order	
b. Selection of tools and materials	
c. Use of trade knowledge	
2. Product	40%
a. Accuracy (free of mistakes)	
b. Precision (adherence to limits	
c. Finish (as required)	
3. Work Habits	30%
a. Cleanliness	
b. Order	
c. Care of tools (inventory)	
d. Safety	
e. Economy of materials	
4. Moral-Attitude	15%
a. Cooperation	
b. Iniative	
c. Dependability	

12.0

BRAKE SYSTEM

Listed below each numbered item, are four possible answers. Decide which one of the four is correct, or most nearly correct, and write the corresponding number in the blank space at the right.

1. The master cylinder piston return spring is located between the _____.
   (a) Boot and piston
   (b) Check valve and secondary cup
   (c) Piston and primary cup
   (d) Check valve and primary cup 1. _____

2. Most of the heat is created by braking action is absorbed by the _____.
   (a) Brake shoes
   (b) Braking plate
   (c) Brake drum
   (d) Hydraulic fluid 2. _____

3. The hydraulic fluid returns to the master cylinder reservoir through the _____.
   (a) Compensating port
   (b) Breather port
   (c) Intake port
   (d) Piston bleeder holes 3. _____

4. To aid in the dissipation of heat, brake drums are sometimes provided with _____.
   (a) Wrap around springs
   (b) Cooling fins
   (c) The same
   (d) Increased if pumped 4. _____

5. Self-adjusting action takes place whenever the brake is _____.
   (a) Applied
   (b) Applied while backi
   (c) Released
   (d) Pumped 5. _____

AUTOMOTIVE MECHANICS

PRACTICAL DEMONSTRATION RATING SCALE

ITEMS TO BE RATED	PERCENT VALUE ASSIGNED
1. Planning	15%
a. Operation order	
b. Selection of tools and materials	
c. Use of trade knowledge	
2. Product	40%
a. Accuracy (free of mistakes)	
b. Precision (adherence to limits)	
c. Finish (as required)	
3. Work Habits	30%
a. Cleanliness	
b. Order	
c. Care of tools (inventory)	
d. Safety	
e. Economy of materials	
4. Moral-Attitude	15%
a. Cooperation	
b. Iniative	
c. Dependability	

COURSE AUTOMOTIVE MECHANICS (BASIC)

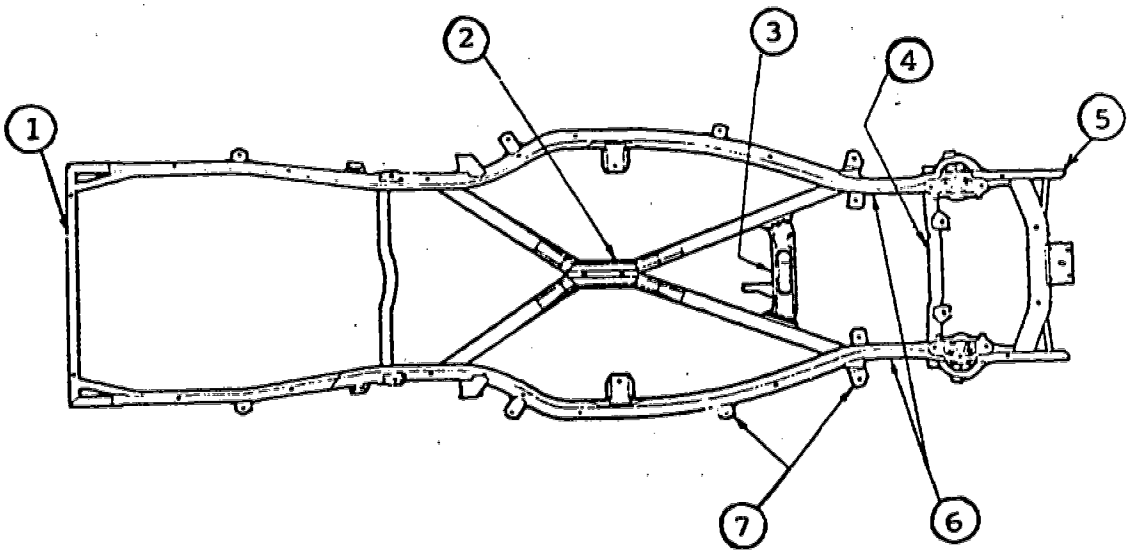
TERMINAL PERFORMANCE OBJECTIVE NO. 13.0

FRAMES, SPRINGS AND SUSPENSION SYSTEMS

Upon completion of this unit, the student will correctly diagnose, service and repair components pertaining to the following: frames, springs and suspension systems as per factory specifications. 80% of the students will correctly answer 75% of the questions and perform, at 75% on the job rating scale, each of the I.P.O. criterion measures.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		13.0	Test attached.
13.1	Given an automobile the student will measure the frame, check the spring alignment, and will correct any discrepencies to factory specifications.	13.1	Measure parts on the diagram by using service manual and diagram.
13.2	The student will correctly identify the component parts of an automobile frame on a given diagram using service manual and chart.	13.2	Identify parts on the diagram by using service manual and diagram.
13.3	The student will diagnose and replace necessary parts on a given damaged automobile frame.	13.3	Using shop order, inspection sheet, service manual, repair frame assigned to you.
13.4	The student will place a given car on the front end machine and will check and correct caster.	13.4	Check and correct alignment.
13.5	Given a front tire and wheel assembly on the car, the student will dynamically balance the tire and wheel assembly in accordance with manufacturers specifications using spinner.	13.5	Balance tire and wheel using wheel spinner type balancing equipment.

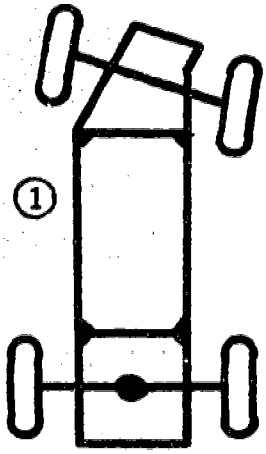
Below is a picture of a typical automobile frame with the main parts numbered. Place the number of the part in front of the correct identifying name below. There may be extra identifying names.



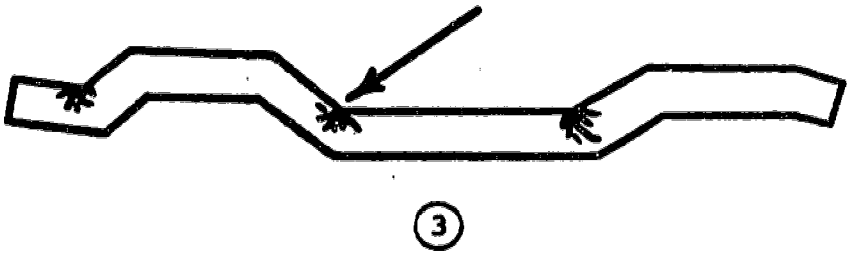
Identifying Names

____	Cross Member - rear	____	Engine Mounts
____	Body Mount	____	Horn
____	Side Rail	____	Transmission Mount
____	"X" Crossmember	____	Differential Mount

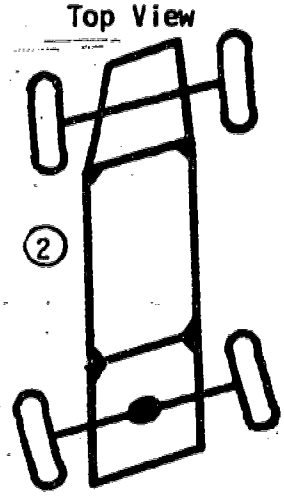
Below are pictured four (4) numbered schematic drawings of exaggerated automobile frame misalignment and a list of their identifying names. Match each drawing with its correct identifying name by placing the number of the drawing beside the name which best describes it.

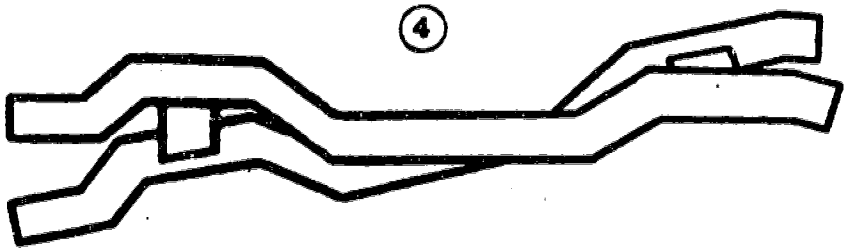


Top View



Side View





_____Diamond _____Twist _____Side Sway _____Sag & Buckle

13.5

Select the one (1) choice that correctly identifies the two technical methods used to balance automotive tire and wheel assemblies.

_____ A. High Speed - Low Speed

_____ B. Spin and Reverse Spin

_____ C. Static and Dynamic

_____ D. Wind Tunnel and Spinning

ACCREDITATION NUMBER 9043

COURSE TITLE: AUTOMOTIVE MECHANICS (BASIC)

TERMINAL PERFORMANCE OBJECTIVE NO. 14.0 RUNNING SYSTEM

Upon completion of this unit, the student will diagnose, service, and repair the following running system components: clutch, transmission, and differential. 80% of the students will perform at 75% efficiency on the job rating scale, each of the I.P.O. criterion measures.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
		14.0	Test attached.
.1	Given a clutch assembly the student will inspect, repair and replace the flywheel, driven disc assembly and release bearing so that when road tested there won't be any slippage or chattering.	14.1	Repair slipping and chattering clutch.
.2	Given a list of four answers, the student will correctly check the multiple choice statement that explains the purpose of a standard transmission.	14.2	Correctly answer questions on attached test.
.3	Given a schematic drawing of a typical transmission and a list of identifying positions the student will correctly list which position the transmission is in.	14.3	Describe which gear the transmission is in, using attached drawing.
.4	Given a noisy differential assembly, the student will correctly disassemble, clean, inspect, and replace damaged parts so as to adjust gear backlash to .006 plus or minus .001 using dial indicator.	14.4	Repair noisy differential.

AUTOMOTIVE MECHA.

PRACTICAL DEMONSTRATION RATING SCALE

ITEMS TO BE RATED	PERCENT VALUE ASSIGNED
1. Planning	15%
a. Operation order	
b. Selection of tools and materials	
c. Use of trade knowledge	
2. Product	
a. Accuracy (free of mistakes)	40%
b. Precision (adherence to limits)	
c. Finish (as required)	
3. Work Habits	
a. Cleanliness	30%
b. Order	
c. Care of tools (inventory)	
d. Safety	
e. Economy of materials	
4. Moral-Attitude	15%
a. Cooperation	
b. Iniative	
c. Dependability	

Place an X in front of the one explanation that best explains the purpose of a standard transmission in an automobile.

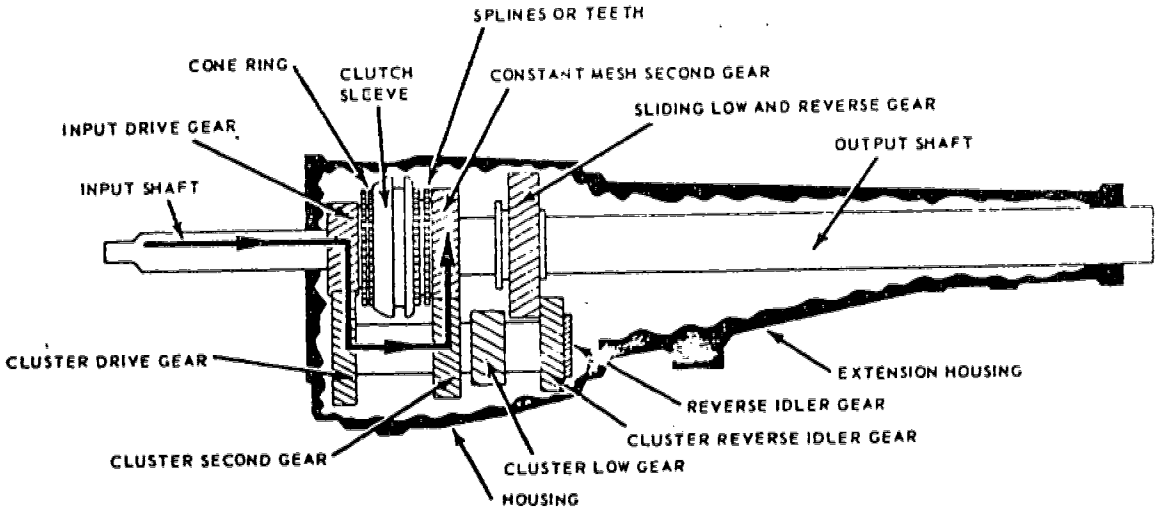
____ A. It is a low cost way to help provide the needed power to move the automobile. The transmission gears multiply the engine torque for more power to get the car moving and other gears give speed for cruising.

____ B. The transmission divides the engine power in half, giving each rear wheel the same amount of power to drive the car forward or in reverse.

____ C. It is a gear box that just makes the car go forward or in reverse.

____ D. The transmission connects and disconnects the engine from the rear wheels and gives equal power to both rear wheels.

Below is a side view drawing of a three speed transmission showing the power flow from the engine to the drive line. Place an X in front of the transmission gear position shown in the drawing.



This transmission is in

____ first gear

____ second gear

____ third gear

____ reverse gear

____ neutral

Disassemble differential and inspect the parts listed below. Place an X in front of the part name (s) that are defective.

Check List
(If no good. . . X)

____ Housing

____ Case

____ Bearing Caps

____ Case Side Bearings

____ Ring Gear

____ Side Gear

____ Pinion Gear

____ Pinion Gear Thrust Washer

____ Flange

____ Drive Pinion Gear