These two vocational instructional modules on basic automobile ignition timing and on engine operation, four-stroke cycle, are two of eight such modules designed to assist recently arrived Arab students, limited in English proficiency (LEP), in critical instructional areas in a comprehensive high school. Goal stated for this module is for the student enrolled in automobile courses to learn the correct basic ignition timing of an automobile engine and to explain the operation of the automobile engine during the four-strokes of the operating cycle and to identify the various parts of the engine. Each module consists of these parts: title; program goal and performance objectives; a pronunciation key; a language page which offers the pronunciation, definition, and usage of key terms in English and in Arabic; a pretest; bilingual (English and Arabic) language (vocabulary and usage) activities; evaluation; pretest and activity answer sheets; and a list of supplementary materials and their location. For each activity the objective, a list of materials needed, procedure, and evaluation are provided in addition to the necessary activity sheets or pages. Each module contains three activities. (YLB)
AUTOMOBILE ENGINE: BASIC IGNITION TIMING

معرك الـيارة: توقيت
الإحتراق الرـئيسي
ABOUT THE PROJECT

The Fordson Arabic Bilingual Demonstration Project is designed to assist recently arrived Arab students, limited in English proficiency (LEP), to adapt to a large and comprehensive high school. The project consists of academic and vocational instructional modules, reading services to teachers and students, bilingual aide and resource services, computer and television modules, staff development activities, and home-community liaison.

ABOUT THE INSTRUCTIONAL MODULES

The modules were designed to assist LEP students in critical instructional areas throughout the school curriculum. These areas of focus were determined by a needs survey of the entire Fordson school community. Each module consists of seven parts: title, objectives, pretest, language (vocabulary and usage) activities, evaluation, and supplementary materials. Modules were translated, duplicated, and field tested.

ABOUT THE AUTHOR

James E. Vick did his undergraduate work at Western Michigan University and his graduate training at Eastern Michigan University. James has worked in the Automotive area at Fordson High School for the past 14 years. The skills developed in this unit were those he and his students defined as critical for better understanding Automobile Engine Operation.
CREDITS AND ACKNOWLEDGEMENTS:

Special Assistance:

Jean H. Miller, Ed.D. - Editor
Pat Coulter - Reading Consultant
Susan Field - Special Needs Coordinator
Albert R. Harp - Translation Editor
Wendy Sample - Graphics
Christine Rajda - Typist
Tahsine Bazzi - Translation

Demonstration Staff:

Clark Burnett - ESL Instructor/Audio-Visual Consultant
Albert Harp - Bilingual Resource Coordinator
Fouad Moawad - Bilingual Instructor
Jim Petrie - Facilitator
Wafa Unis - Instructional Aide/Home Community Liaison
Issaaif Beydoun - Instructional Aide
Elham Hamdan - Instructional Aide
Karim Michael - Instructional Aide
Rihab Ahmad - Secretary

Dearborn Board of Education:

Agnes Dobronski - President
Kathleen Walsh - Vice President
Mary Bugeia - Secretary
Suzanne McIlhiny - Treasurer

Ronald Chapman - Trustee
David MacKenzie - Trustee
Ruth Sample - Trustee

Administration:

Dr. Thomas McLennan - Superintendent
Dr. Fred Schrieber - Director, Division of Instructional Services
Mr. John Dutton - Coordinator, Project Development
Mr. Bill Letsche - Principal, Fordson High School

Special Acknowledgement:

The interest, concern, and commitment of Mr. Harvey Failor, Principal of Fordson High School from 1964-1982, to the Demonstration Project was a source of strength and inspiration to us all.
Portions of or the entire instructional module may be reproduced except for commercial purposes without the permission of the author or the Fordson Bilingual Demonstration Project.

This Project was supported by the United States Department of Education.

The contents of this instructional module were developed under a grant for the United States Department of Education. However, those contents do not necessarily represent the policy of that agency, and you should not assume endorsement by the Federal Government.
AUTOMOBILE ENGINE OPERATION

BASIC IGNITION TIMING

Developed By:

James E. Vick
This bilingual module has been developed to assist limited English proficiency students in learning the basic ignition timing of an automobile engine. The unit is designed for students enrolled in automotive courses.

GENERAL OBJECTIVE: The student will be able to identify the correct basic ignition timing of an automobile engine with 100% accuracy.

SPECIFIC OBJECTIVES: After completing the activities of this module, the student will:

1. identify the compression stroke of an engine; (Activity 1)
2. identify the exhaust stroke of an engine; (Activity 1)
3. click-over an engine's crankshaft using the keyswitch; (Activity 2)
4. locate the ignition timing marks; (Activity 3)
5. locate the timing mark "0" degrees; (Activity 3)
6. identify the correct time for the spark plug to fire; (Activity 3)
7. position piston number 1 at the top of the compression stroke on an operating engine with 100% accuracy. (Activity 3)
Write the correct letter in the space available.

1. The part of the engine that moves up and down in the cylinder is the:
   a. valve    c. cylinder
   b. crankshaft  d. piston

2. The part of the engine that turns when the piston moves down is the:
   a. crankshaft  c. cylinder
   b. combustion  d. valve

3. The part that makes the gasoline burn is the:
   a. piston    c. spark plug
   b. battery   d. exhaust

4. When the piston moves up and down the crankshaft:
   a. moves up   c. strokes
   b. moves down d. turns

5. The piston moves up on the:
   a. compressions and intake stroke
   b. intake and exhaust stroke
   c. exhaust and compression stroke
   d. power and exhaust stroke

Go on to next page.
6. The stroke that squeezes the gasoline and air mixture together is the:
   a. intake stroke
   b. compression stroke
   c. power stroke
   d. exhaust stroke

7. During the compression stroke the gasoline-air mixture:
   a. stays in the cylinder
   b. moves out the exhaust valve
   c. burns
   d. moves into the engine

8. During the exhaust stroke the gasoline-air mixture:
   a. stays in the cylinder
   b. moves out of the cylinder
   c. moves into the cylinder
   d. burns

9. When the piston is on the compression stroke, it is:
   a. moving down
   b. turning
   c. moving up
   d. spinning over and over

10. When the piston is on the exhaust stroke, it is:
    a. moving down
    b. turning
    c. moving up
    d. spinning over and over
11. Adjusting the engine so that the spark plug fires at the proper time is called:
   a. mixture adjustment
   b. compression setting
   c. basic ignition timing
   d. setting the intake valve

12. You can identify the compression stroke by:
   a. looking at the timing marks
   b. removing a spark plug and feeling for air blowing out of the plug hole
   c. removing a spark plug, looking into the cylinder
   d. checking for air going into the cylinder

13. The timing marks show the:
   a. condition of the battery
   b. position of the piston
   c. condition of the spark plug
   d. position of the spark plug

14. The timing marks are located on the:
   a. points
   b. right side of the engine
   c. left side of the engine
   d. front of the engine

Go on to next page.
15. You can click-over the engine by:
   a. tapping with a wrench
   b. pushing the car
   c. turning the keyswitch
   d. hitting with a hammer

16. The parts shown below are called:
   a. crankshaft
   b. piston
   c. timing marks
   d. engine numbers

17. The spark plug should fire when the piston is:
   a. at the top of the exhaust stroke
   b. at the top of the compression stroke
   c. at the bottom of the intake stroke
   d. at the bottom of the power stroke

Go on to next page.
18. When air blows out of the spark plug hole and the timing marks are lined-up, the engine:
   a. will start easily because "basic timing" is correct
   b. will cough and shake because "basic timing" is wrong
   c. not start
   d. burn up in flames

19. The timing marks line-up when the piston is on the:
   a. intake stroke
   b. compression stroke
   c. compression and exhaust stroke
   d. power and intake stroke

20. Which stroke of the four-stroke cycle is shown below:
   a. intake stroke
   b. compression stroke
   c. power stroke
   d. exhaust stroke
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>d</td>
<td>6</td>
<td>b</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>7</td>
<td>a</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>c</td>
<td>8</td>
<td>b</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>d</td>
<td>9</td>
<td>c</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>c</td>
<td>10</td>
<td>c</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>b</td>
<td>11</td>
<td>c</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>a</td>
<td>12</td>
<td>b</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>b</td>
<td>13</td>
<td>b</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>c</td>
<td>14</td>
<td>d</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>c</td>
<td>15</td>
<td>c</td>
<td>20</td>
</tr>
</tbody>
</table>
PRONUNCIATION KEY

/a/ as in Adam
/æ/ as in cake
/e/ as in let
/ə/ as in meet
/i/ as in sit
/ɪ/ as in ice cream
/o/ as in hot
/ɔ/ as in Coke
/u/ as in Seven Up
/ʊ/ as in blue
/b/ as in boy
/c equals /s/ as in cents (10¢)
/d/ as in day
/f/ as in four
/g equals /g/ as in go
/ʤ/ as in page
/h/ as in he
/j equals /ʤ/ as in jail
/k/ as in kick
/l/ as in Cola

/m/ as in man
/n/ as in man
/p/ as in Dr. Pepper
/qu equals /kw/ as in quit
/r/ as in run
/s/ as in sun
/t/ as in ten
/v/ as in van
/w/ as in woman
/x/ as in extra
/y/ as in yet (sometimes /ɛ/ as in many)
/z/ as in zebra
/sh/ as in shut
/ch/ as in church
/ng/ as in sing
/th/ (voiced) as in this
/θ/ (unvoiced) as in thing
/ʊ/ as in food
/u/ as in good
1. **basic ignition timing**
   making the spark plug fire at the correct time when the piston is at the top of the compression stroke

2. **click**
   A noise that is very short. A noise that sounds like a click can be made by turning the key on a car and quickly letting go of the key. This is called "clicking-over" the engine.

3. **compression**
   pushing or squeezing gasoline and air together to make a high pressure

4. **compression stroke**
   when the piston moves up in the cylinder to squeeze the gasoline-air mixture tightly in the cylinder. The piston moves up and both valves are closed.

5. **crankshaft**
   The part of the engine that turns when the piston is pushed down by the explosion of the gasoline-air mixture. The pistons are connected to the crankshaft.

6. **cylinder**
   The round hole in the engine block that the piston fits into. The piston moves up and down in the cylinder.
7. **degrees**
small parts of a circle. The degrees are the numbers the mechanic uses to find the position of the piston and crankshaft.

8. **exhaust**
to push out of a space. The burned gas that is left in a cylinder when the gasoline is burned.

9. **four-stroke cycle**
the order of events that causes the automobile engine to run. The four strokes of the piston are: intake stroke, compression stroke, power stroke, exhaust stroke.

10. **gasoline-air mixture**
the explosive gas that is used in the engine to make it run. The gasoline must be mixed with air correctly to get the best burning and best power.

11. **identify**
to place the correct name on an object or person. The students were told to identify their desks by placing their name on pieces of paper.

12. **keyswitch**
the part in the car where the key is placed and turned to start the engine. When the keyswitch is turned the crankshaft will turn or rotate.
VOCABULARY (continued)

13. piston
the round part in the engine that moves up and down and fits into the cylinder. The piston is pushed down by the exploding gasoline and air and then the crankshaft turns.

14. spark plug
the part of the engine that causes the gasoline and air to explode. The spark plug is connected to a wire and it is put in a hole at the top of the cylinder.

15. stroke
to move a part in a straight line from one place to another place. The piston moves from the top of the cylinder to the bottom. This is called the piston stroke.

16. timing mark
small numbers on the front of the engine to show the position of piston number one. These marks are used to set the "basic ignition timing".
Write the word neatly and correctly in English in the space available.

1. basic ignition timing
2. click
3. compression
4. compression stroke
5. crankshaft
6. cylinder
7. exhaust
8. degrees
9. four-stroke cycle
10. gasoline-air mixture
11. identify
12. keyswitch
13. piston
14. stroke
15. spark plug
16. timing marks
STUDENT ACTIVITY 1

OBJECTIVE: The student will be able to identify the compression stroke and the exhaust stroke of an engine.

MATERIALS NEEDED: A pencil and Activity 1.

PROCEDURE: The student will complete the activity as described on the following pages.

EVALUATION: The teacher will know that the student has achieved this objective when the student has completed the worksheet with all activities 100% accurate.
STUDENT ACTIVITY 1 (continued)

Write in the correct words for steps 1, 2, 3, 4, 5, and 6 of this activity.

1. Write the correct name for each stroke from the list below in the blank.

intake stroke
compression stroke
power stroke
exhaust stroke

Diagram showing the intake stroke, compression stroke, power stroke, and exhaust stroke.
2. Write the name of the stroke described in each sentence below.

a. ______________ Stroke
   The piston moves down and the gasoline-air mixture comes into the cylinder.

b. ______________ Stroke
   The piston moves up and squeezes the gasoline-air mixture together and both valves are closed.

c. ______________ Stroke
   The spark plug fires and the piston is pushed down by the exploding gasoline-air mixture.

d. ______________ Stroke
   The piston moves up and the burned mixture is pushed out of the cylinder through the valve.
3. Look at the diagrams below. Fill-in the blank spaces.

a. Is the air squeezed tighter in the compression stroke or in the exhaust stroke?

   ___________________________ Stroke

b. The air is squeezed tighter during the compression stroke because both valves are__________.

   ___________________________
4. If we remove a spark plug and put a finger over the spark plug hole, we feel air coming out of the hole. More air will be squeezed out the spark plug hole during the stroke because both valves are closed.

5. The stroke of the engine with more air coming out of the spark plug hole is the stroke.

6. We can identify the compression stroke by removing a plug and placing our finger over the spark plug. When we feel , we have found the compression stroke.
STUDENT ACTIVITY 2

OBJECTIVE: The student will describe how to "click-over" an engine to position the piston at the top of the compression stroke.

MATERIALS NEEDED: A pencil and Activity 2.

PROCEDURE: The student will complete the activities as directed on the following pages.

EVALUATION: The teacher will know that the student has achieved this objective when the student has completed the worksheet with 100% accuracy.
1. Look at the drawings below and do what you are told:

Fill-in each blank using one of these words: up, down, turning, crankshaft, click, key.

The piston is moving ________
and the crankshaft is ________

2. The pistons move down and up in the cylinder. This makes the crankshaft turn or rotate. When we turn the key, the engine crankshaft rotates and the pistons move ________ and ________.

---

1 - انظر إلى الرسوم أدناه ثم قم بمحاذاة
هو مطلوب.
املاً كل فراغ باستخدام واحدة من هذه الكلمات: أعلى، أسفل، يدور، عمود المرفقي، طلق (كل)، مفتاح.

بتحرك المكبس إلى
والعمود المرفقي ________

2 - يتحرك المكابس إلى أسفل وإلى أعلى
في الأسطوانة. هذا الأمر يجعل العمود المرفقي يدور، عندما ندير المفتاح.

يدور العمود المرفقي للمحرك وتحرك المكابس إلى ________ وإلى ________.
3. We can get the pistons to move down and up by using our hand to turn the __________.

4. The piston below is moving ______ and the crankshaft is ________.

5. When the piston moves ________ and ________, the __________ turns.

6. If we want to move the piston up or down, we can do this by turning the key. The engine will make a noise that sounds like ________ when we turn the key and let it go. We can move the pistons by clicking over the engine using the _______.

3 - يمكننا جعل المكابس تتحرك إلى الأسفل أو إلى الأعلى باستخدام يدنا لإدارة

4 - يتحرك المكبس أدناه إلى ____________ والعمود المرفق.

5 - عندما يتحرك المكبس إلى ____________ والي الأخرى، فإن اليدور.

6 - يمكننا تحريك المكابس إلى الأعلى أو إلى الأسفل وذلك سيرادعة المفتاح، عندما يدبر المفتاح

قليلًا، ثم نعيد إلى وضعه الأول، يمكننا تحريك المكابس وذلك يجعل المحرك يطاق

باستخدامنا ____________.
7. If we want the pistons to stop and go, we must turn and let go of the

STUDENT ACTIVITY 3

OBJECTIVE: The student will identify the correct time that the spark plug should fire.

MATERIALS: A pencil and Activity 3.

PROCEDURE: The student will complete the activities as directed on the following pages.

EVALUATION: The teacher will know that the student has achieved this objective when the student has completed the worksheet with all activities 100% correct.
Read this worksheet very carefully:
Fill-in the blank space with the correct word or letter.

1. The picture below is a drawing of an engine. It is labeled so that you can find the front of an engine and the timing marks.

Draw an arrow on the engine below showing the front of the engine. Label the arrow front.
2. Timing marks show the position of the piston and crankshaft as the piston moves up and down. The timing marks are numbers showing degrees. They are on a plate on the front of the engine.

Draw an arrow on the engine below showing where the timing marks are located on the engine. Label the arrow timing-marks. Draw a circle around the timing mark "0" degrees.
STUDENT ACTIVITY 3 (continued)

3. When the crankshaft turns, the timing mark also turns. When we "click" the key, the crankshaft will turn. If the timing marks are not lined-up correctly, we have to __________ the key to turn the crankshaft.

4. When the piston is at the top of the stroke, the timing mark "0" degrees lines-up. We can see if the piston is at the top of the stroke by looking at the __________ marks.

5. We can see if the piston is at the top of the stroke when the timing mark number __________ is lined-up.
6. When the timing mark stops at "0" degrees, the piston will stop at the top of the stroke. Which drawing below shows the piston at the top of the stroke?

A.  

B.  

C.  

7. The spark plug should fire when the piston is at the top of the compression stroke. The piston and crankshaft can be moved to the correct position for spark plug firing. We can do this by "clicking" the ________.
8. The piston is at the top of the stroke on both the compression stroke and on the exhaust stroke. When the spark plug is removed, we can tell the compression stroke because air will blow out of the spark plug when the piston is coming up.

9. The spark plug should fire **only** at the top of the compression stroke. The compression stroke is the stroke that has air blowing out of the hole.

10. Draw a spark at the spark plug in the drawing below to show the correct basic ignition timing.
11. Basic ignition timing is correct when the _______ ________ fires when the piston is at the top of the ________ stroke.

"11 - يكون توقيت الاعمال الاساسي صحيحاً إذا اطلقت ________ ________ عندما يكون المكبس في أعلى شوط ________.

---------------------------------------------------------------
ANSWER SHEET - ACTIVITIES

Activity 1
1. a. intake  b. compression  c. power  d. exhaust
2. a. intake  b. compression  c. power  d. exhaust
3. a. compression  b. closed
4. compression
5. compression
6. spark, hole, air

Activity 2
1. down, turning
2. up, down
3. key
4. up, turning
5. up, down, crankshaft
6. click, key
7. key

Activity 3
3. click
4. timing
5. "0"
6. drawing C
7. key
8. hole
9. spark plug
10. spark plug "b"
11. spark plug, compression
EVALUATION

The pretest should be used for post test evaluation.

PERFORMANCE TEST

The teacher or the aide will also provide the following performance test if time and facilities permit:

Obtain an operating engine with number one spark plug removed.

The student will position piston number one at the top of the compression stroke with 100% accuracy.
SUPPLEMENTARY PAGE

Books:

Auto Mechanics Fundamentals

Auto Shop
Fordson High School Media Center

Filmstrips:

Fundamentals of the Gasoline Engine (filmstrip and cassette)

Fordson High School Media Center
Kit 629.2, c. 5
FORDSON BILINGUAL DEMONSTRATION PROJECT

AUTOMOBILE ENGINE: FOUR-STROKE CYCLE
ABOUT THE PROJECT

The Fordson Arabic Bilingual Demonstration Project is designed to assist recently arrived Arab students, limited in English proficiency (LEP), to adapt to a large and comprehensive high school. The project consists of academic and vocational instructional modules, reading services to teachers and students, bilingual aide and resource services, computer and television modules, staff development activities, and home-community liaison.

ABOUT THE INSTRUCTIONAL MODULES

The modules were designed to assist LEP students in critical instructional areas throughout the school curriculum. These areas of focus were determined by a needs survey of the entire Fordson school community. Each module consists of seven parts: title, objectives, pretest, language (vocabulary and usage) activities, evaluation, and supplementary materials. Modules were translated, duplicated, and field tested.

ABOUT THE AUTHOR

James E. Vick did his undergraduate work at Western Michigan University and his graduate training at Eastern Michigan University. James has worked in the Automotive area at Fordson High School for the past 14 years. The skills developed in this unit were those he and his students defined as critical for better understanding Automobile Engine Operation.
CREDITS AND ACKNOWLEDGEMENTS:

Special Assistance:

Jean H. Miller, Ed.D. - Editor
Pat Coulter - Reading Consultant
Susan Field - Special Needs Coordinator
Albert R. Harp - Translation Editor
Wendy Sample - Graphics
Christine Rajda - Typist
Tahsine Bazzi - Translation

Demonstration Staff:

Clark Burnett - ESL Instructor/Audio-Visual Consultant
Albert Harp - Bilingual Resource Coordinator
Fouad Moawad - Bilingual Instructor
Jim Petrie - Facilitator
Wafa Unis - Instructional Aide/Home Community Liaison
Issaaf Beydoun - Instructional Aide
Elham Hamdan - Instructional Aide
Karim Michael - Instructional Aide
Rihab Ahmad - Secretary

Dearborn Board of Education:

Agnes Dobronski - President
Kathleen Walsh - Vice President
Mary Bugeia - Secretary
Suzanne McIlhiny - Treasurer

Administration:

Dr. Thomas McLennan - Superintendent
Dr. Fred Schrieber - Director, Division of Instructional Services
Mr. John Dutton - Coordinator, Project Development
Mr. Bill Letsche - Principal, Fordson High School

Special Acknowledgement:

The interest, concern, and commitment of Mr. Harvey Failor, Principal of Fordson High School from 1964-1982, to the Demonstration Project was a source of strength and inspiration to us all.
Portions of or the entire instructional module may be reproduced except for commercial purposes without the permission of the author or the Fordson Bilingual Demonstration Project.

This Project was supported by the United States Department of Education.

The contents of this instructional module were developed under a grant for the United States Department of Education. However, those contents do not necessarily represent the policy of that agency, and you should not assume endorsement by the Federal Government.
AUTOMOBILE ENGINE

ENGINE OPERATION, FOUR-STROKE CYCLE

Developed By:
James E. Vick
and
Imad Fadlallah
This bilingual module has been developed to assist limited English proficiency students in learning the operation of the automobile engine during the four-strokes of the operating cycle, and identifying the various parts of the engine. This module is designed for students enrolled in automotive courses.

GENERAL OBJECTIVE: The student will be able to explain the operation of the automobile engine during the four-strokes of the operating cycle and identify the parts of the engine by scoring at least 75% on a written test.

SPECIFIC OBJECTIVES:

The student will:

1. explain in writing and orally the operation of the engine on the intake stroke, compression stroke, power stroke and exhaust stroke.

2. identify the parts of the engine listed below:
   - piston
   - cylinder
   - crankshaft
   - connecting rod
   - cylinder head
   - valve
   - camshaft
   - timing gears
   - piston rings
   - rocker arm
   - valve spring
   - push rod
Which description (A-D) best describes the parts of the engine listed (1-4).

PART I:

1. intake valve
2. exhaust valve
3. piston
4. cylinder

A. round plug that slides up and down in the cylinder
B. hole in cylinder block that contains piston
C. valve through which fuel mixture goes into the cylinder
D. valve through which burned fuel passes on its way from cylinder to exhaust manifold

Go on to next page.
Which description best describes the parts listed.

PART II:

1. combustion chamber
2. power stroke
3. compression stroke
4. stroke

A. distance piston moves when traveling from TDC to BDC
B. area above piston with piston on top dead center
C. piston's movement used for transmitting power of burning fuel mixture to crankshaft.
D. piston's movement used for compressing the fuel mixture in the engine cylinder.

Go on to next page.
Select the correct answer.

**PART III:**

1. The order of the four strokes of the cycle are:

   A. exhaust, power, intake, compression
   B. compression, exhaust, power, intake
   C. intake, compression, power, exhaust
   D. power, compression, intake, exhaust

2. It takes _______ revolution/s of the crankshaft to complete one cycle.

   A. 1
   B. 2
   C. 4
   D. 8

3. The parts that keep the camshaft rotating correctly with the crankshaft are:

   A. timing chains
   B. timing gears
   C. timing belts
   D. all of the above

Go on to next page.
PART IV: Fill in the blanks with the correct words.

1. These are the four strokes of the cycle.

A. The number 1 in the diagram above is the ______ stroke.

B. The number 2 in the diagram above is the ______ stroke.

C. The number 3 in the diagram above is the ______ stroke.

D. The number 4 in the diagram above is the ______ stroke.

Go on to next page.
PART IV (continued)

Using diagram, answer the following questions.

(1.)

2. Study figure number 1:

piston is moving ________, both valves are ________, spark plug is ________, so this is the ________ stroke

Go on to next page.
3. In the diagram above, figure 2: piston is moving ________, the ________ valve is ________, and the ________ valve is ________, so this is the ________ stroke.

4. In the diagram above, figure 3: ________ valve is ________, air fuel mixture is drawn into cylinder, ________ valve is ________, so this is the ________ stroke.
PART IV (continued)

Using diagram, answer the following questions:

(1.) Both valves are ________ piston is moving ________, so this is the _________ stroke.

(2.) Stop

(3.) Stop

(4.) Stop

AIR-FUEL MIXTURE
PRETEST ANSWER KEY

PART I
1. C
2. D
3. A
4. B

PART II
1. B
2. C
3. D
4. A

PART III
1. C
2. B
3. D

PART IV
1. (A) power
   (B) exhaust
   (C) intake
   (D) compression
2. down, closed, firing, power
3. up, exhaust, open, intake, closed, exhaust
4. intake, open, exhaust, closed, intake
5. closed, up, compression
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Pronunciation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>/a/</td>
<td>as in Adam</td>
<td></td>
</tr>
<tr>
<td>/e/</td>
<td>as in let</td>
<td></td>
</tr>
<tr>
<td>/i/</td>
<td>as in sit</td>
<td></td>
</tr>
<tr>
<td>/o/</td>
<td>as in hot</td>
<td></td>
</tr>
<tr>
<td>/u/</td>
<td>as in Seven Up</td>
<td></td>
</tr>
<tr>
<td>/b/</td>
<td>as in boy</td>
<td></td>
</tr>
<tr>
<td>/c/</td>
<td>as in cents (10¢)</td>
<td></td>
</tr>
<tr>
<td>/d/</td>
<td>as in day</td>
<td></td>
</tr>
<tr>
<td>/f/</td>
<td>as in four</td>
<td></td>
</tr>
<tr>
<td>/g/</td>
<td>as in go</td>
<td></td>
</tr>
<tr>
<td>/h/</td>
<td>as in he</td>
<td></td>
</tr>
<tr>
<td>/j/</td>
<td>as in jail</td>
<td></td>
</tr>
<tr>
<td>/k/</td>
<td>as in kick</td>
<td></td>
</tr>
<tr>
<td>/l/</td>
<td>as in Cola</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Pronunciation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>/m/</td>
<td>as in man</td>
<td></td>
</tr>
<tr>
<td>/n/</td>
<td>as in man</td>
<td></td>
</tr>
<tr>
<td>/p/</td>
<td>as in Dr. Pepper</td>
<td></td>
</tr>
<tr>
<td>qu</td>
<td>equals /kw/ as in quit</td>
<td></td>
</tr>
<tr>
<td>/r/</td>
<td>as in run</td>
<td></td>
</tr>
<tr>
<td>/s/</td>
<td>as in sun</td>
<td></td>
</tr>
<tr>
<td>/t/</td>
<td>as in ten</td>
<td></td>
</tr>
<tr>
<td>/v/</td>
<td>as in van</td>
<td></td>
</tr>
<tr>
<td>/w/</td>
<td>as in woman</td>
<td></td>
</tr>
<tr>
<td>/x/</td>
<td>as in extra</td>
<td></td>
</tr>
<tr>
<td>/y/</td>
<td>as in yet (sometimes /e/ as in many)</td>
<td></td>
</tr>
<tr>
<td>/z/</td>
<td>as in zebra</td>
<td></td>
</tr>
<tr>
<td>/sh/</td>
<td>as in shut</td>
<td></td>
</tr>
<tr>
<td>/ch/</td>
<td>as in church</td>
<td></td>
</tr>
<tr>
<td>/ng/</td>
<td>as in sing</td>
<td></td>
</tr>
<tr>
<td>/th/</td>
<td>(voiced) as in this</td>
<td></td>
</tr>
<tr>
<td>/th/</td>
<td>(unvoiced) as in thing</td>
<td></td>
</tr>
<tr>
<td>oo</td>
<td>equals /u/ as in food</td>
<td></td>
</tr>
<tr>
<td></td>
<td>/u/ as in good</td>
<td></td>
</tr>
</tbody>
</table>
1. **block** (blōk)
   main part of the engine containing cylinders

2. **camshaft** (kām' shāft')
   a shaft in the engine used to open the valve

3. **camshaft gear** (kām'shāft' gēr)
   gear that is used to drive camshaft; one part of the timing gear

4. **combustion** (kōm bū'shən)
   burning of the gasoline and air mixture

5. **compression** (kōm prēsh' ūn)
   squeezing gasoline and air tightly together; this gives it more power when burned

6. **connecting rod** (kŏ nēkt' ĭng rōd)
   connecting part between piston and crankshaft

7. **crankshaft** (krānk shāft')
   to transfer the up and down movement of the piston to a circular motion

8. **crankshaft gear** (krānk shāft' gēr)
   gear mounted on front of crankshaft used to drive the crankshaft

9. **cylinder** (sīl' ēn dēr)
   round hole in the block that the piston moves up and down in
10. cylinder head (sil' in der hed)

covers top of cylinder. In many cases the cylinder head contains the valves.

11. exhaust stroke (eg zôst strôk)

4th movement of piston used to push burned gases from cylinder.

12. valve lifter (vâlv lift êr)

round piece of metal that rides on the camshaft.

13. intake stroke (in' tâk strôk)

movement of the piston that pulls gasoline and air to cylinder.

14. intake valve (in' tâk valv)

engine part that opens to let gasoline and air into cylinder.

15. exhaust valve (eg zôst vâlv)

part of the engine that opens to let burned gasoline and air out of the cylinder.

16. four-stroke cycle (si'k'îl)

The way that the engine runs. Two complete revolutions of crankshaft to fire each piston once. The four strokes are: intake, compression, power, exhaust.

17. stroke (strôk)

distance piston moves when traveling from the top of the cylinder to the bottom of the cylinder.
18. **timing gears** (tîm′ ′ ɪng gêrz)

the two gears attached to the camshaft and the crankshaft. These gears cause the camshaft to be turned by the crankshaft.

19. **piston** (pis′ tûn)

a round plug that slides up and down in cylinder.

20. **piston ring** (pis′ tûn ring)

a part that goes around the piston to stop gasoline and air from going between the piston and cylinder.

21. **rocker arm** (rök′ er)

arm used to direct upward motion of pushrod into a downward or opening motion of the valve.

22. **push rod** (pûsh rôd)

rod that connects valve lifter to rocker arm. Used on valve-in-head installation.

23. **valve spring** (væl′ sprîŋg)

used to keep valves closed.
DIRECTIONS: Fill in the blanks with the correct vocabulary. Refer to the Language Page if necessary.

1. There are _________ valves in a four cylinder engine.

2. The _________ fastens the piston to the crankshaft.

3. The _________ is the 4th movement devoted to push out burned gases from cylinder.

4. In the _________ air fuel mixture is drawing into the cylinder while the _________ is open.

5. The _________ prevent the leak between the piston and the cylinder wall.

6. The _________ contains the cylinders.

7. The _________ transfer the up and down movement of the piston to a circular motion.

8. In the _________ stroke, the piston is pushed down.

9. The _________ is the distance that the piston travels.

1 - يوجد ___________ مصادر في محرك له أربع أسطوانات.

2 - يربط المكبس بالعمود المرفق.

3 - أن ___________ هو الحركة الرابعة التي تطرد الغازات المحروقة من الأسطوانة.

4 - في ___________ يسحب خليط الوقود والهواء إلى داخل الأسطوانة بينما يكون مفتوحاً.

5 - ___________ تحول دون شرب الخليط بين المكبس وجدار الأسطوانة.

6 - يحتوي ___________ على الأسطوانات.

7 - ___________ يحول حركة المكبس الطالعة والنازلة إلى حركة دائرية.

8 - في شوط ___________ يدفع المكبس نحو الأسفل.

9 - ___________ هو المسافة التي يقطعها المكبس.
10. ____________ let the crankshaft turn the camshaft.

11. The ____________ is used to direct upward motion of pushrod into a downward or opening motion of the valve.
1. (A) Study the drawing shown below. Remember the names of the parts and where they are located.
Label the parts of the engine drawing below:

cylinder

cylinder head

piston rings

piston

crankshaft

connecting rod
STUDENT ACTIVITY 2 (continued)

2. (A) Study the drawing shown below. Remember the names of the parts and where they are located.

(B) Look at these parts in your auto shop.

- ROCKER ARM
- VALVE SPRING
- VALVE
- CAMSHAFT
- PUSHROD
- TIMING GEARS
2. (C) Label these parts of the engine on the drawing below:

- timing gears
- pushrod
- rocker arm
- valve
- camshaft
- valve spring

- 7
- 8
- 9
- 10
- 11
- 12
STUDENT ACTIVITY 3

FOUR STROKE CYCLE WORKSHEET

Read this worksheet carefully and do as you are told.

Write in the correct words in the blank spaces.

Use correct spelling and write neatly.

A. Look at the picture on the next page and write in the correct words below.

1. When the crankshaft turns, the piston moves ________ and the ________ valve is open. The ________ valve is closed.

2. When the piston moves down, it pulls ________ and ________ into the cylinder.

3. This stroke of the cycle is called the ________ stroke.

4. The job of the intake stroke is to pull ________ and air into the cylinder.

5. The ________ stroke is the first stroke of the four-stroke cycle.
STUDENT ACTIVITY 3 (continued)

FOUR STROKE CYCLE WORKSHEET

Intake Valve

Exhaust Valve

Gasoline and Air

Piston

Intake Stroke
8. Look at the picture at the bottom of the page and write the correct words on the lines below.

1. When the crankshaft turns one more one-half turn, the piston moves __________ and the intake valve and the exhaust valve are both __________.

2. Because the gasoline and air cannot go out the valves, it is squeezed in the cylinder above the ________.

3. During the __________ stroke, the gasoline and air are compressed.

4. The piston moves up and both valves are closed during the __________ stroke.

5. The __________ stroke is the second stroke of the four-stroke cycle.
C. Look at the picture below and write the correct words on the lines.

1. In this stroke, both the valves are ________.

2. During the ________ stroke, the ________ is pushed down.

3. The ________ of the piston turns the ________.

4. The power stroke is the ________ stroke of the cycle.

5. During the ________ stroke, the air-fuel mixture is ________.
D. Look at the picture below and write in the correct words.

1. When the crankshaft turns one-half turn the piston moves ________ and the intake valve is ________ but the exhaust valve is ________.

2. When the piston moves up, it pushed burned ________ and ________ out of ________.

3. This stroke of the cycle is called the ________ stroke.

4. The job of the exhaust stroke is to ________ gases out of the cylinder.

5. The exhaust stroke is the ________ of the four stroke cycle.

D. - انظر الى الصورة المناسبة أدناه واملأ بالكلمات المناسبة.

1 - عندما يتحرك المكبس إلى الاعلى فإنه يدفع ال ________ وال ________ المحرق إلى خارج ال ________.

2 - يتم شوطة الدورة هذا، شوطة ________.

3 - وظيفة الشوطة العادية - شوطة الطرد ________ الغازات المحترقة إلى خارج الاسطوانة.

4 - ان شوطة الطرد هو الشوط رقم ________ من الدورة ذات الشوام الأربعة.

Exhaust Stroke
شوط الاحتراق
ANSWER KEY

STUDENT ACTIVITY 1:

1. 8
2. connecting rod
3. exhaust stroke
4. intake stroke, intake valve
5. rings
6. engine block
7. crankshaft
8. power
9. stroke
10. timing chain
11. rocker arm

STUDENT ACTIVITY 2 B:

1. cylinder head
2. piston rings
3. connecting rod
4. crankshaft
5. cylinder
6. piston

STUDENT ACTIVITY 2 C:

7. rocker arm
8. valve spring
9. pushrod
10. valve
11. camshaft
12. timing gears

STUDENT ACTIVITY 3 A:

1. downward, intake exhaust
2. air, fuel
3. intake
4. fuel
5. intake

STUDENT ACTIVITY 3 B:

1. upward, closed
2. piston
3. compression
4. compression
5. compression

STUDENT ACTIVITY 3 C:

1. closed
2. power, piston
3. movement, crankshaft
4. third
5. power, burned

STUDENT ACTIVITY 3 D:

1. upward, closed, open
2. gasoline, air, cylinder
3. exhaust
4. push
5. fourth
EVALUATION

The pretest should be used for post-test evaluation.

The teacher can also elect to do evaluation during a discussion activity. The main instruments for discussion will be projections of transparencies of the engine diagrams in this module.
**SUPPLEMENTARY MATERIALS**

<table>
<thead>
<tr>
<th>MATERIALS USED</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook: &quot;Auto Mechanics Fundamentals&quot;</td>
<td>Auto shop and Fordson Media Center</td>
</tr>
<tr>
<td>Film: &quot;ABC's of Internal Combustion&quot;</td>
<td>Dearborn Public Schools Media Center</td>
</tr>
<tr>
<td>Filmstrip: &quot;Engine Operation&quot; 4 FS and Cassette</td>
<td>Fordson Media Center</td>
</tr>
</tbody>
</table>