education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

MECHANICAL TECHNOLOGY

EXEMPLAR PAPER

MARKS: 200

TIME: 3 hours

This question paper consists of 18 pages.

154 0 E

INSTRUCTIONS AND INFORMATION

1. Write your examination and centre number in the spaces provided on the ANSWER BOOK.

2. This question paper consists of SIX questions.

3. Answer ALL the questions.

4. Sketches must be neat.

5. Show ALL the calculations.

6. Candidates may use non-programmable scientific calculators and drawing/ mathematical instruments.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS
(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 1 - 9)

Various possible options are provided as answers to the following questions. Choose the correct answer and write only the letter (A - D) next to the question number (1.1 - 1.20) in the answer book, for example 1.21 A.

1.1 Which ONE of the following is an unsafe condition in a workplace?

A Poor lighting system
B Not using goggles when drilling
C Running in the workplace
D Horseplay

1.2 What is the primary purpose of the Occupational Health and Safety (OHS) Act?

A To ensure the safety of the factory owner
B To ensure the safety of the workers
C To ensure that all machines are always in good working order
D To ensure that workers always obey their supervisors

1.3 Which spanner would you use for removing a nut that is recessed by 65 mm?

A Flat spanner
B Ring spanner
C Combination spanner
D Socket spanner

1.4 How would you remove a C-shaped ring from a collar that is held onto a shaft?

A Hammer and chisel
B Screw driver
C Circlip pliers
D Water pump pliers

1.5 The process of bending metal back and forth many times will ...

A soften the metal and removes internal stresses.
B increase the metal's resistance to scratching and abrasion.
C gradually harden the metal and break it.
D toughen the metal.

1.6 Which of the following materials is the best conductor of electricity?

A Copper
B Nylon
C Steel
D Aluminium

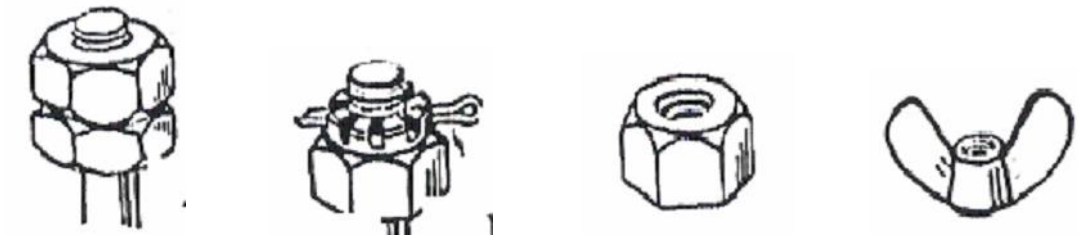
1.7 What is the unit measure of power?

A Joule
B Watt
C Newton
D Newton metre

1.8 Which unit is used to specify the length of the lathe bed?

A mm
B cm
C m
D kg

1.9 Identify a lock nut from the sketches indicated below:



A **B** **C** **D**

FIGURE 1.1

1.10 Identify the type of joint indicated on the drawing below:

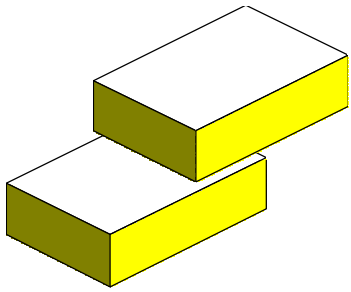


FIGURE 1.2

A Corner joint
B T-joint
C Double L-joint
D Lap joint

1.11 What is the unit measure of force?

A Newton
B Joule
C Kilogram
D Watt

1.12 What type of force does **F** in the following diagram indicate?

FIGURE 1.3

A Shear force
B Hand force
C Compression force
D Tensile force

1.13 What type of motion is torque?

A Running motion
B Turning motion
C Compression motion
D Pushing motion

1.14 What is the main reason for maintenance of mechanical equipment?

A To promote wear and tear
B To beautify the equipment
C To prolong the life of the equipment
D To increase breakdown

1.15 Which ONE of the following is NOT a cause of excessive wear in machinery?

A Too much pressure between moving parts
B Lubrication
C Overheating
D Ceasing

1.16 A belt drive system has ...

A two gear wheels that mesh together.
B two pulley wheels sand a belt.
C a lever and a pivot point.
D two gear wheels and a chain.

1.17 Which ONE of the following fluids is commonly used in hydraulic systems?

A Water
B Petrol
C Gas
D Oil

1.18 The words pneumatic, hydraulic, mechanical and electrical, each describes a/an ...

A type of power transmission system.
B energy source.
C type of motor.
D form of power loss.

1.19 What does the abbreviation SI stand for in heat engines?

A System injection
B Secondary injection
C Spark ignition
D Spark injection

1.20 State the correct stroke order of a four-stroke, four-cylinder, spark-ignition engine.

A Induction, compression, power, exhaust
B Compression, power, induction, exhaust
C Power, exhaust, compression, induction
D Exhaust, compression, power, induction **(20 x 1)** **[20]**

QUESTION 2: APPLIED MECHANICS
(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 6 AND 8)

2.1 If gear A is turning clockwise, in which direction will gear C turn and state the reason why?

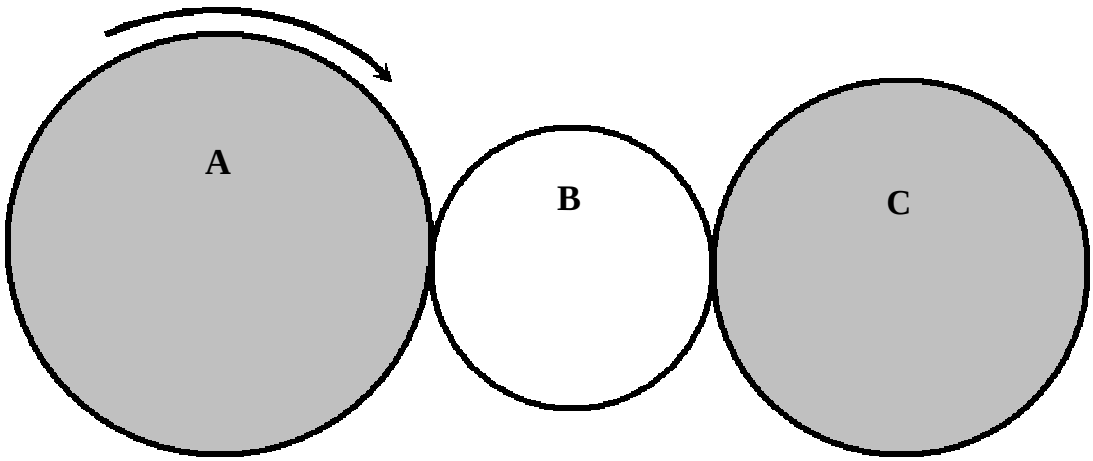


FIGURE 2.1

(2)

2.2 In which direction will pulley C turn if pulley A is turning anti-clockwise?

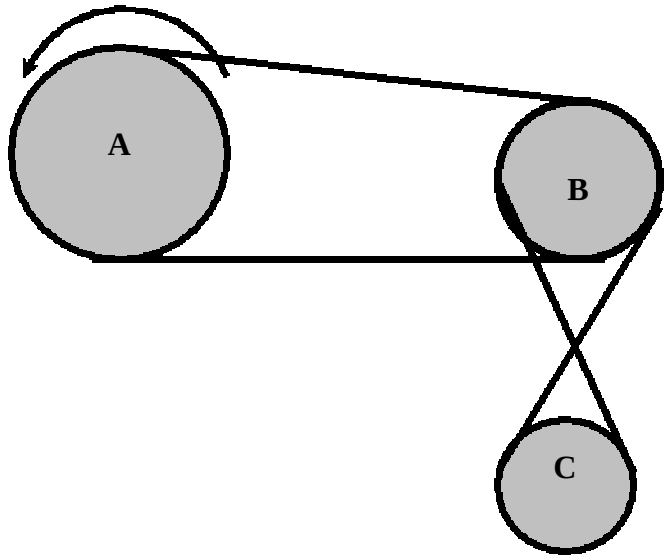


FIGURE 2.2

(2)

2.3 Which of the following diagrams describe one of the following movements?

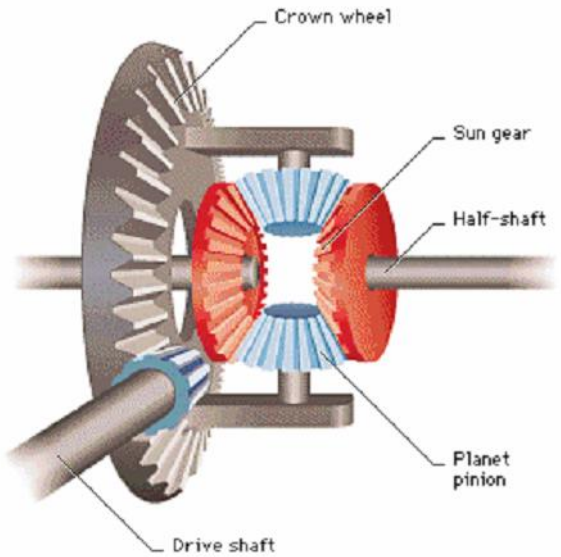
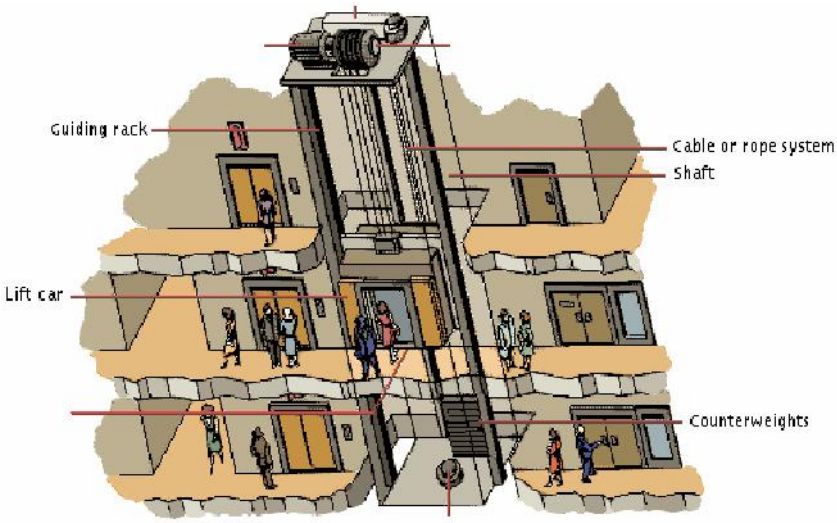
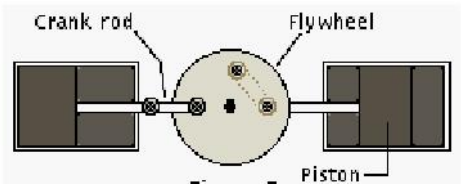
	TYPE OF MOVEMENT		DIAGRAM
2.3.1	Linear	A	
2.3.2	Reciprocating	B	
2.3.3	Rotational	C	

TABLE 2.1

(6)

2.4 State ONE advantage and ONE disadvantage of a pulley transmission system. (2)

2.5 Calculate the pressure induced in a circular structure with a diameter of 5 m and a force of 200 N acting upon it. (10)

2.6 The figure shown below shows a bicycle. Study the figure and answer the questions that follow:

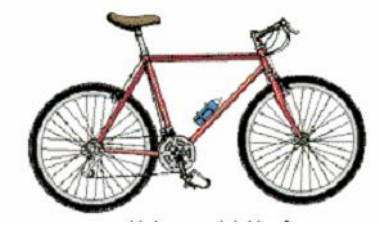


FIGURE 2.3

2.6.1 State TWO advantages of a chain drive system over a belt drive system. (4)

2.6.2 Why do bicycles have a large pedal sprocket and a small back axle sprocket? (4)

2.6.3 Bicycles often have 3, 5 or 10 gears. State TWO advantages of having a range of gears on a bicycle. (4)

2.7 During the recent school trip to Carnival City, three children enjoyed a part of the day on a swing. The forces exerted on the swing by children are shown on the diagram below.

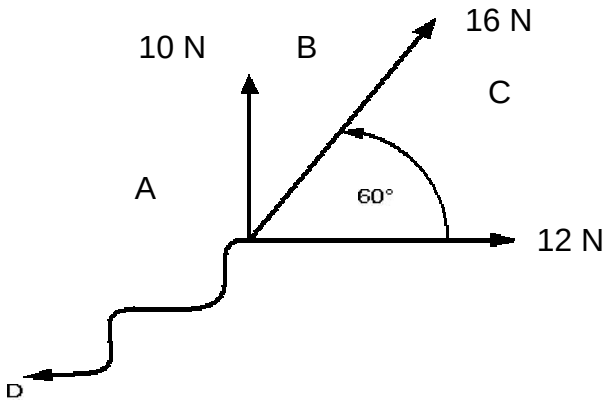


FIGURE 2.4

Use a scale of 1 cm = 2 N and determine the magnitude and direction of the resultant force. (16)
[50]

QUESTION 3: TOOLS AND EQUIPMENT
(LEARNING OUTCOME 3: ASSESSMENT STANDARD 2)

3.1 Name the THREE types of pliers and their functions.

FIGURE 3.1

(6)

3.2 Why is the tension on the blade of a hacksaw adjustable and why should the teeth face forward? (4)

3.3 State TWO main factors to be considered when deciding on the type of power drill. (2)

3.4 What is the purpose of a vice with a rotating base?

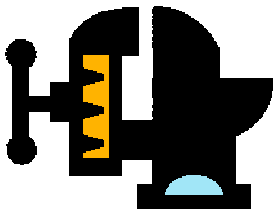


FIGURE 3.2

(2)

3.5 Why should a scriber be used with extreme care? (2)

3.6 Describe how you would go about testing whether the sides of a work piece are square in relation to each other?

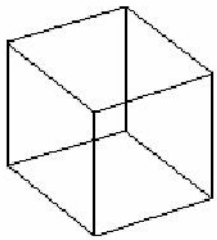


FIGURE 3.3

(4)
[20]

QUESTION 4: MATERIALS
(LEARNING OUTCOME 3: ASSESSMENT STANDARD 3)

4.1 Complete the table below in your answer book. Choose the correct properties for the definitions given from the list below:

hardness; plasticity; conductivity; toughness; strength

PROPERTIES	DEFINITIONS
4.1.1	Deforms under load and does not return to its original shape when the load is removed
4.1.2	Resists abrasion and penetration
4.1.3	Withstands shock loads without fracture
4.1.4	Withstands loads which tend to make it increase in length

TABLE 4.1 (4)

4.2 Define the following properties of materials:

4.2.1 Ductility (1)

4.2.2 Malleability (1)

4.2.3 Elasticity (1)

4.2.4 Brittleness (1)

4.3 Explain the following terms and give ONE example of each:

4.3.1 Ferrous metal (2)

4.3.2 Non-ferrous metal (2)

4.4 Define an *alloy*. (2)

4.5 List TWO alloy elements and ONE property for each. (4)

4.6 Name TWO main types of plastic materials. (2)
[20]

QUESTION 5: MANUFACTURING PROCESS, CONSTRUCTION METHODS AND SAFETY (LEARNING OTUCOME 3: ASSESSMENT STANDARDS 1, 4 AND 5)

5.1 Mr Pieter owns a garage where he frequently services and spray paints vehicles. He normally disposes of oil into the municipal drains that lead to the Vaal River. In his backyard, he also has a huge old generator, powered by a diesel engine. This generator is used to supply electricity for all his equipment, as well as a refrigerator where the community can store their perishable food.

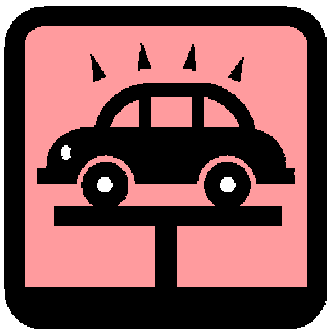


FIGURE 5.1

5.1.1 Name TWO positive and TWO negative influences of Mr Pieter's activities in the community. (4)

5.1.2 Suggest how Mr Pieter's negative activities can be solved without seriously interfering with his daily activities and profit margin. (3)

5.1.3 Name at least FOUR groupings of dangers encountered in a mechanical workshop. (4)

5.1.4 Define the *green house effect*.

FIGURE 1 (1)

5.2 Why has petrol with a lead content been banned since January 2006 in South Africa? Which petrol is available as a replacement? (3)

5.3 During a practical demonstration using a pedestal drilling machine, the educator was summoned by the principal to his office to attend an urgent meeting. He left the workshop without giving clear instructions to the learners what to do. A learner, whose father owns a machine shop, attempted to demonstrate the operation of the machine to his fellow Grade 10 learners. The learner forced another learner to hold a piece of flat bar with his/her hands while trying to drill a hole through the piece of flat bar. As the flat bar got warm, the learner loosened the grip which resulted in a flying piece of steel which injured another learner.
The finger of the learner holding the flat bar, was cut and bled profusely. Blood spilt everywhere. One brave learner used his fingers to try to stop the blood from oozing from the wounded finger. One learner used his senses and ran to a teacher next to the workshop to ask for assistance.

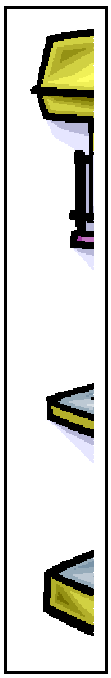


FIGURE 5.3

5.3.1 Point out what should be the *responsibility* and *accountability* of the learners with regard to safety measures. (2)

5.3.2 What procedures should the learner follow when dealing with an open wound? (3)

5.3.3 Name at least ONE human right that was violated in this scenario. Substantiate your answer. (2)

5.4 Label the parts of a lathe as illustrated in FIGURE 5.1 Write the number and next to it, the part. (Each component = ½ mark.)

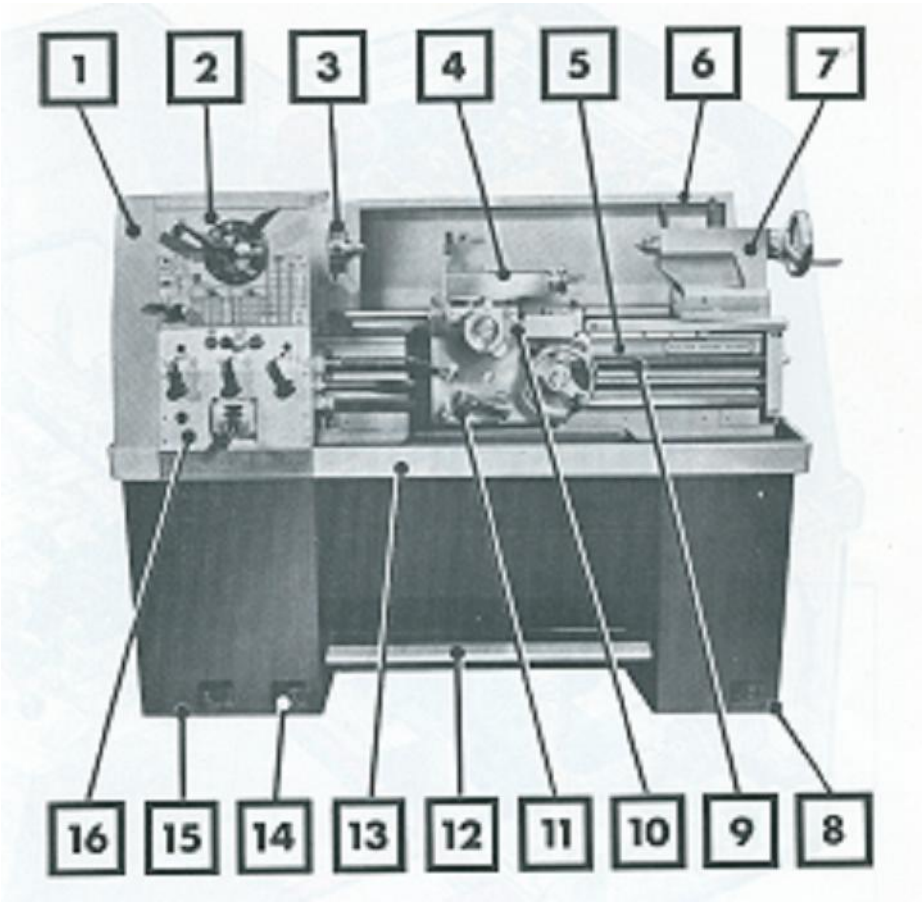


FIGURE 5.4: THE LATHE (8)

5.5 Make neat, labelled sketches to differentiate between the following lap joints. Show both the normal and diagonal pitch:

5.5.1 Single staggered lap joint (4)

5.5.2 Double staggered lap joint (4)

5.6 The size of a bolt and nut is indicated as shown in the following example:

M12 x 1.75

5.6.1 What does 'M' stand for? (1)

5.6.2 Which measurement does '12' indicate? (1)

5.6.3 Which measurement does '1.75' indicate? (1)

5.7 Identify the following machine processes by matching the description to the machine. Write only the letter (A - D) next to the question number (5.7.1 - 5.7.4).

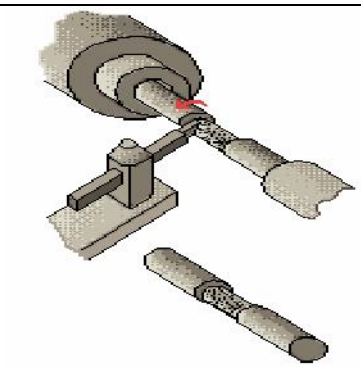
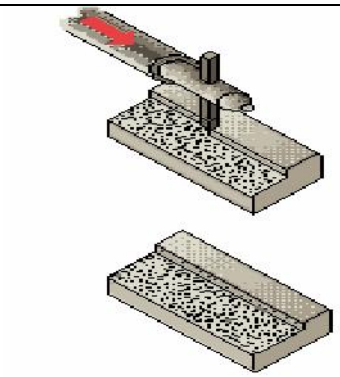
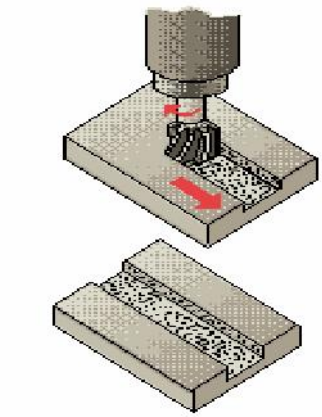
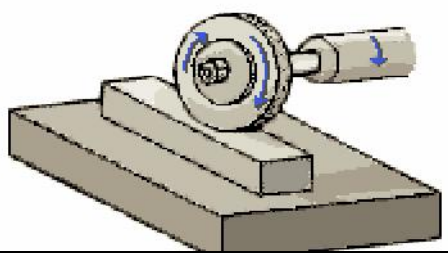
	MACHINE		DESCRIPTION
A		5.7.1	grinding (removes metal with a rotating abrasive wheel)
B		5.7.2	milling machine (creates flat or contoured surfaces by feeding the work piece into a circular cutting device)
C		5.7.3	shaper (produces flat surfaces by sliding a sharp edge cutting tool against a stationary work piece)
D		5.7.4	diameter cutting (holds and rotates a work piece while a cutting tool removes additional material)

TABLE 5.1

(5)

5.8 Make a neat, labelled sketch of the tip of a cutting tool used on the lathe and indicate the following:

5.8.1 Front clearance (1)

5.8.2 Front rake (1)

5.8.3 Side rake (1)

5.8.4 Side clearance (1)

[50]

QUESTION 6: HEAT ENGINES AND MAINTENANCE (LEARNING OUTCOME 3: ASSESSMENT STANDARDS 7 AND 9)

6.1 Wear and tear is caused by the generation of heat when materials with rough surfaces are rubbed over each other. To solve this problem, technologists investigated the circumstances and invented lubricants and coolants.

FIGURE 6.1

6.1.1 Name TWO functions of lubricants. (4)

6.1.2 Explain the term *viscosity*. (2)

6.1.3 Explain TWO methods of lubrication in a four-stroke engine. (2)

6.1.4 Explain how the two-stroke engine is lubricated. (6)

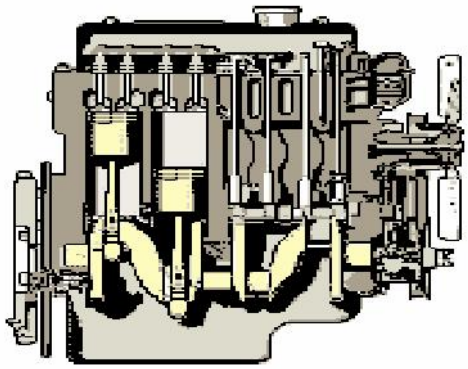


FIGURE 6.2

6.2 Explain the principle of operation of a four-stroke spark-ignition engine. (16)

6.3 List FIVE items to be checked by the driver of a vehicle on a weekly basis. (10)
[40]

TOTAL: 200