basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

MECHANICAL TECHNOLOGY: AUTOMOTIVE

MAY/JUNE 2026

MARKING GUIDELINES

MARKS: 200

These marking guidelines consist of 22 pages.

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Instructions to marker: Mechanical Technology – Automotive

1. **General marking instructions:**

1.1 During marking of multiple-choice questions, only ONE possible answer can be accepted. If the candidate indicated two or more responses, ONLY the first response will be recognised/ acknowledged and marked according to the marking guidelines.

1.2 Where the number of responses of the candidate exceeds the required number stated in the question, only the first required number of responses will be accepted. E.g. if the question states 'Name THREE …' and the candidate stated four different responses, ONLY the first three will be accepted and recognised and remaining responses marked wrong.

1.3 When the question states that the candidate is expected (a) to describe step by step and (b) to explain:
(a) If a candidate is required to describe step by step, e.g. a process in 4 steps, only the first 4 responses should be considered.
(b) However, if for example a candidate is required to explain a process, we need to consider that a candidate may write a long description, but not necessarily well organised. In this case the marker needs to evaluate the complete statement to judge if the candidate explained the required outcome satisfactorily and allocate marks on merit.

1.4 If question numbering of subquestions is not correct according to question paper sequence, the responses can be accepted if a sequence pattern can be identified.

1.5 Attention must be given to mark allocation in questions where two (2) marks were allocated to one response, e.g. (**Any 1 x 2**).

1.6 ONE tick must be allocated for each mark awarded and no global marking is allowed.

1.7 Unanswered and incorrect responses of questions must be indicated with a cross (X).

1.8 All blank pages in an ANSWER BOOK must be crossed out to indicate that the pages have been seen by the marker.

1.9 Attention must be given to questions where the candidate did not complete the answer but continued the answer(s) on subsequent pages in the answer book. Continue marking such questions and award marks, if applicable. If a question is answered twice, mark the first response.

1.10 During calculation marking, pay attention to the position of the tick mark(s) in the marking guideline.

1.11 If a candidate skipped a step where a tick mark is allocated in the marking guideline, but the final answer is correct, the total amount of tick marks must be indicated by the marker to indicate full marks awarded for the question correctly answered so that the examination assistants can verify marks awarded.

1.12 If the unit required for calculations is specified in the question, the final answer can be considered correct without explicitly stating the unit, provided that the numerical value matches the unit specified or used in the question.

1.13 If an incorrect unit is stated in the candidates answer during calculations, the answer will be marked incorrect even if the value itself is correct.

1.14 Attention must be given to calculation-type questions when different methods are used by candidates to obtain the correct answer. Consider answers where candidates have rounded off in subquestions and it affects the final answer.

1.15 Attention must be given to special marking instructions to the marker which are stated for specific questions in the marking guideline.

1.16 A red line must be drawn by the marker to indicate the end of each question.

1.17 Marks of subquestions must be indicated in the outside margins of the ANSWER BOOK pages and NOT in the inside margins.

1.18 When subquestion marks are allocated in the outside margins they must be in line with the subquestion and NOT be circled.

1.19 Total marks of a question must be indicated on the red line drawn by the marker and circled as to indicate marks for particular questions.

1.20 Marker must transfer marks to cover page and ensure correctness of transfer.

1.21 Markers should familiarise themselves with the question and answer before evaluating the responses of candidates.

1.22 Always interpret the responses of the candidates within the context of the question.

1.23 Mark what the candidate wrote and do not interpret or predict responses.

1.24 Accept incorrect spelling in answers unless the spelling changes the meaning of the answer.

1.25 Pencil work is normally acknowledged as rough work and should not be considered/marked.

1.26 As a rule, marks are not awarded for formulas that are found in the attached formula sheet. Only when a formula has been correctly manipulated, can a mark be awarded. Marks will also be awarded for correct formulas given by candidates if the particular formula is not found in the formula sheet. Marks are awarded for correct substitution.

1.27 Incorrect value from previous calculations substituted, in the right place in the formula, will be awarded marks.

2. **Specific marking instructions:**

2.1 In QUESTIONS 2.2.1 and 2.2.2, special attention must be given to answers from candidates as the question specifically ask WHILE the machines are working and not before or after it has been switched on or off.

2.2 In QUESTION 5.2 special attention must be given to answers from candidates as the differences between compression and leakage test must match each other.

2.3 In QUESTION 8.1 special attention must be given to answers from candidates as the cause and the corrective measure must match each other.

2.4 In QUESTION 8.4 special attention must be given to answers from candidates as the cause and the corrective measure must match each other.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS (GENERIC)

1.1 B ✓ (1)

1.2 A ✓ (1)

1.3 A ✓ (1)

1.4 C ✓ (1)

1.5 B ✓ (1)

1.6 B ✓ (1)
[6]

QUESTION 2: SAFETY (GENERIC)

2.1 **Identify safety device:**

2.1.1 **Vertical band saw:**
- Wheel guard ✓
- Adjustable guard ✓
- Blade guard ✓

(Any 1 x 1) (1)

2.1.2 **Power-driven guillotine:**
- Rear view mirror ✓
- Fixed guard ✓
- Finger protectors ✓
- Automatic sweep-away ✓
- Rear light curtain ✓
- Two hand control devices ✓
- Emergency stop buttons ✓
- Electronic presence-sensing devices (air curtains) ✓

(Any 1 x 1) (1)

2.1.3 **Drill press:**
- Belt cover ✓
- Chuck cover ✓

(Any 1 x 1) (1)

2.1.4 **Bench grinder:**
- Perspex shield ✓
- Wheel guard ✓

(Any 1 x 1) (1)

2.2 **Safety rules of the following machines:**

2.2.1 **Horizontal band saw:**
- Do not adjust the machine. ✓
- Do not force feed. ✓
- Do not remove the cuttings/swarf. ✓
- Do not adjust coolant supply. ✓
- Keep your fingers away from moving parts. ✓
- Do not leave the machine unattended. ✓

(Any 2 x 1) (2)

2.2.2 **Arc welding equipment:**
- Do not leave the machine unattended. ✓
- Use tongs/pliers to hold the hot metal. ✓ (2)

2.3 **Workshop layouts:**

2.3.1 Product layout ✓ (1)

2.3.2 Process layout ✓ (1)

[10]

QUESTION 3: MATERIALS (GENERIC)

3.1 **Types of tests/Test results:**

3.1.1 Mild steel ✓ (1)

3.1.2 Tends to crack ✓ (1)

3.1.3
- Cast steel ✓
- High speed steel ✓
- Tool steel ✓
- High carbon steel ✓

(Any 1 x 1) (1)

3.1.4 Cuts easily ✓ (1)

3.2 **Iron-carbon equilibrium diagram:**

A. Carbon content ✓
B. Temperature ✓
C. AC3/Upper critical temperature ✓
D. AC1/Lower critical temperature ✓ (4)

3.3 **Quenching media used in extreme cooling:**
- Brine/Salt water ✓
- Water ✓
- Liquid Nitrogen ✓

(Any 1 x 1) (1)

3.4 **Colour code of metal:**
- To identify the type of metal. ✓
- To identify carbon content especially after the metal was stored. ✓
- To identify the profile/size of the metal. ✓

(Any 2 x 1) (2)

3.5 **Annealing process:**

A. Grain growth ✓
B. Recrystallization ✓
C. Recovery ✓ (3)

[14]

QUESTION 4: MULTIPLE-CHOICE QUESTIONS (SPECIFIC)

4.1	C ✓	(1)
4.2	B ✓	(1)
4.3	B ✓	(1)
4.4	C ✓	(1)
4.5	C ✓	(1)
4.6	A ✓	(1)
4.7	B ✓	(1)
4.8	A ✓	(1)
4.9	C ✓	(1)
4.10	B ✓	(1)
4.11	A ✓	(1)
4.12	A ✓	(1)
4.13	B ✓	(1)
4.14	D ✓	(1)

[14]

QUESTION 5: TOOLS AND EQUIPMENT (SPECIFIC)

5.1 **Compression tester:**

5.1.1 **Wet compression test:**
- Pour/squirt some oil onto the piston through the spark plug hole. ✓
- Do the compression test. ✓
- Compare the readings to the dry compression test reading. ✓ (3)

5.1.2 **Function:**
It measures the pressure created ✓ when the piston is at top dead centre on the compression stroke. ✓ (2)

5.1.3 **Advantage of card-type tester:**
The compression tester automatically records the readings ✓ on the card in the tester. (1)

5.2 **Cylinder leakage test:**

5.2.1 **Label:**
A. Pressure regulator/knob ✓
B. Cylinder leakage/percentage gauge/meter ✓
C. Adaptor hose/pipe ✓ (3)

5.2.2 **Reason for locking crankshaft:**
Prevent the engine from turning during the test. ✓ (1)

5.2.3 **Differences between compression and leakage test:**

COMPRESSION TEST	CYLINDER LEAKAGE TEST
• Measures the compression pressure in the engine. ✓	• Determines the pressure lost. ✓
• Can only determine if pressure is lost at piston compression rings. ✓	• Determines where the compression is lost. ✓
• Uses compression pressure to perform the test. ✓	• Compressed air is supplied to the cylinder to perform the test. ✓
• Engine is turned when performing the test (Dynamic test). ✓	• Engine is stationery when performing the test (Static test). ✓
• Measured in Bar/kPa. ✓	• Measures in percentages (%). ✓

(Any 2 comparisons x 2) (4)

5.3 **Exhaust gas analyser**:
To determine the percentage or amount ✓ of different gases found in the exhaust gases. ✓ (2)

5.4 **Wheel alignment equipment:**

5.4.1 **Placement of bubble gauge:**
It is placed in the centre of the stub axle. ✓ (1)

5.4.2 **Brake lock application:**
- King pin inclination (KPI) ✓
- Caster ✓ (2)

5.4.3 **Purpose of turntables:**
- Allows the wheels to turn sideways. ✓
- Measures the angle that the wheels turn sideways. ✓
- Provides a measurement to centre the steering. ✓

(Any 2 x 1) (2)

5.5 **OBD-II scanner specifications:**

- VIN ✓
- Make of the vehicle ✓
- Model of the vehicle ✓
- Engine type ✓

(Any 2 x 1) (2)
[23]

QUESTION 6: ENGINES (SPECIFIC)

6.1 **Crankshaft:**

6.1.1 **Parts directly driven by crankshaft:**

- Connecting rod ✓
- Flywheel ✓
- Crankshaft pulleys/sprocket ✓
- Vibration damper ✓

(Any 3 x 1) (3)

6.1.2 **Improve engine balance:**

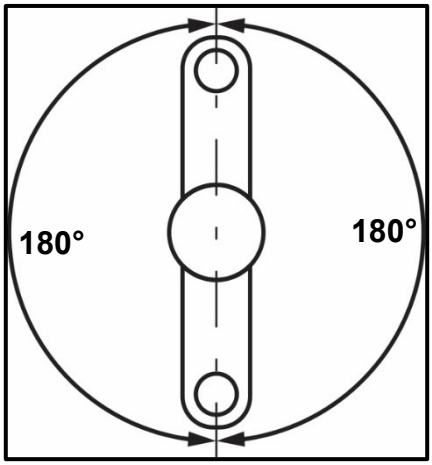
- The weight of the pistons is kept as light as possible. ✓
- The weight of the conrods is kept as light as possible. ✓
- The weight of the pistons is kept equal. ✓
- The weight of the conrods is kept equal. ✓

(Any 2 x 1) (2)

6.1.3 **Improve crankshaft balance:**

Vibration damper ✓ (1)

6.1.4 **Crankpins of a four-cylinder in-line engine:**



- TWO crankpins ✓
- Position of crankpins ✓
- Angles labeled ✓

(3)

6.1.5 **Dynamic balancing of the crankshaft:**

The crankshaft is dynamically balanced when the mass in all directions ✓ from the centre of rotation is equal while it is rotating. ✓ (2)

6.2 **Turbocharger:**

6.2.1 **Types of turbochargers:**
- Non-variable type ✓
- Variable geometry turbocharger (VGT) ✓
- Electrical turbocharger ✓

(Any 2 x 1) (2)

6.2.2 **Part driven by exhaust gases:**
Turbine ✓ (1)

6.2.3 **Idling before turning off the engine:**
- Turbo cools down gradually, ✓ reducing the risk of damage from thermal shock. ✓
- Engine oil continues to circulate through the turbocharger, ✓ helping to cool it down and prevent overheating. ✓
- Prevents oil coking (the formation of carbon deposits) ✓ and blocking of oil lines. ✓

(Any 1 x 2) (2)

6.2.4 **Effect of exhaust gases flow:**
The exhaust gas flow is directed to the turbine of the turbocharger to drive the compressor. ✓ (1)

6.3 **Control turbo boost pressure:**
- Waste gate ✓
- Electronic boost control ✓
- Variable geometry vanes (VGT) ✓
- Blow-off valve (BOV)/Dump valve ✓

(Any 2 x 1) (2)

6.4 **Twin charging i.e. both a supercharger and a turbocharger:**

6.4.1 **Labels:**
A. Intake/Inlet manifold ✓
B. Supercharger ✓
C. Throttle ✓
D. Waste gate ✓ (4)

6.4.2 **Advantages twin charging:**
- Improved low-end torque. ✓
- Increased power output. ✓
- Reduced turbo lag. ✓
- Decreased power sap from supercharger on engine. ✓
- Improve fuel consumption ✓

(Any 2 x 1) (2)

6.4.3 **Disadvantages twin charging:**

- Increased complexity/reduced reliability. ✓
- Higher cost. ✓
- Reduced fuel efficiency under load. ✓
- Increased heat generation. ✓
- Extra engine bay space required. ✓
- Sophisticated boost pressure management required. ✓
- Increased engine stress can reduce engine lifespan/ reliability. ✓
- Tuning requires significant expertise and testing. ✓

(Any 2 x 1) (2)

6.4.4 **Purpose of the intercooler:**

The intercooler is used to cool the air ✓ that has been compressed by the supercharger or turbocharger. (1)

[28]

QUESTION 7: FORCES (SPECIFIC)

7.1 **Definition of brake power:**

- The useable power ✓ developed at the flywheel or the wheels. ✓
- The actual output power ✓ of an engine measured at the flywheel or the wheels. ✓

(Any 1 x 2) (2)

7.2 **Calculations:**

7.2.1 **Swept volume:**

$$\text{Swept volume} = \frac{\pi \times d^2}{4} \times L$$
$$= \frac{\pi \times 9{,}5^2}{4} \times 8{,}8 \quad ✓ \; ✓$$
$$= 623{,}76 \text{ cm}^3 \quad ✓$$

(3)

7.2.2 **Clearance volume:**

$$CV = \frac{SV}{CR - 1}$$
$$= \frac{623{,}76}{16 - 1} \quad ✓ \; ✓$$
$$= 41{,}58 \text{ cm}^3 \quad ✓$$

(3)

7.2.3 **Stroke length:**

$$CV = \frac{SV}{CR - 1}$$
$$SV = CV\,(CR - 1) \quad ✓$$
$$= 41{,}58\,(17 - 1) \quad ✓$$
$$= 665{,}28 \text{ cm}^3 \quad ✓$$

$$SV = \frac{\pi \times D^2}{4} \times \text{length}$$
$$\text{length} = \frac{SV \times 4}{\pi \times D^2} \quad ✓$$
$$= \frac{665{,}28 \times 4}{\pi \times 9{,}5^2} \quad ✓$$
$$= 9{,}386 \text{ cm}$$
$$= 93{,}86 \text{ mm} \quad ✓$$

(6)

7.3 **Methods to lower the compression ratio:**

- Fit thicker gasket between cylinder block and cylinder head. ✓
- Fit a shim between cylinder block and cylinder head. ✓
- Fit piston with suitable lower crowns. ✓
- Fit crankshaft with shorter stroke (with suitable connecting rods). ✓
- Re-bore the cylinders/Decrease the bore. ✓

(Any 3 x 1) (3)

7.4 **Calculations:**

7.4.1 **Torque:**

$$\text{Torque} = \text{Force} \times \text{radius}$$
$$= (42 \times 10) \checkmark \times \frac{700}{1000} \checkmark$$
$$= 294 \text{ Nm} \checkmark$$

OR

$$\text{Torque} = \text{Force} \times \text{radius}$$
$$= (42 \times 9{,}81) \checkmark \times \frac{700}{1000} \checkmark$$
$$= 288{,}41 \text{ Nm} \checkmark$$

(3)

7.4.2 **Brake power:**

$$\text{Brake power} = 2\pi NT$$
$$= 2 \times \pi \times \left(\frac{1800}{60}\right) \checkmark \times 294 \checkmark$$
$$= 55417{,}69 \text{ W}$$
$$= 55{,}42 \text{ kW} \checkmark$$

OR

$$\text{Brake power} = 2\pi NT$$
$$= 2 \times \pi \times \left(\frac{1800}{60}\right) \checkmark \times 288{,}41 \checkmark$$
$$= 54364{,}00 \text{ W}$$
$$= 54{,}36 \text{ kW} \checkmark$$

(3)

7.4.3 **Indicated power:**

IP = PLANn

P = 4 300 x 10^3

$$L = \frac{55}{1000} = 0,055\,m \quad \checkmark$$

$$Area = \frac{\pi \times 0,08^2}{4} \checkmark = 0,0050265\ m^2 = 5,0265 \times 10^{-3}\ m^2 \checkmark$$

$$N = \frac{1\,800}{60 \times 2} \checkmark = \text{ 15 power strokes/ sec } \checkmark$$

n = 4

$$IP = \left(4\ 300 \times 10^3\right) \times (0,055) \times \left(5,0265 \times 10^{-3}\right) \times (15) \times (4) \checkmark$$
$$= 71326,035\,W$$
$$= 71,33\ kW \checkmark$$ (7)

7.4.4 **Mechanical efficiency:**

$$\text{Mechanical efficiency} = \frac{BP}{IP} \times 100$$
$$= \frac{55,42}{71,33} \checkmark \times 100$$
$$= 77,70\ \% \checkmark$$

OR

$$\text{Mechanical efficiency} = \frac{BP}{IP} \times 100$$
$$= \frac{54,36}{71,33} \checkmark \times 100$$
$$= 76,21\% \checkmark$$ (2)

[32]

QUESTION 8: MAINTENANCE (SPECIFIC)

8.1 **High nitrogen oxide (NOx):**
The cause and the corrective measure must match each other.

Cause	Corrective measure
• Improper spark advance ✓	• Reset ignition system. ✓
• Malfunctioning exhaust gas regulator (EGR) ✓	• Replace exhaust gas regulator (EGR) valve. ✓
• Malfunctioning catalytic converter ✓	• Replace the catalytic converter. ✓
• Lean fuel mixture ✓	• Adjust/Reset the fuel mixture. ✓
• Lower octane fuel ✓	• Drain fuel and refill with the correct octane fuel. ✓
• Vacuum leaks ✓	• Repair vacuum leaks. ✓

NOTE: Any 1 cause with any 1 matching corrective measure. (2)

8.2 **Exhaust gas analysis:**

8.2.1 Low ✓ hydrocarbon (HC) (1)

8.2.2 Low ✓ carbon monoxide (CO) (1)

8.2.3 High ✓ carbon dioxide (CO_2) (1)

8.3 **Compression tester:**
- Ensure that the tester can handle the pressure you want to test. ✓
- Ensure the rubber pipes are not perished. ✓
- Ensure the relief valve is working on the tester. ✓
- Zero the tester. ✓
- Ensure you use the correct adapter for the spark-plug hole. ✓

(Any 3 x 1) (3)

8.4 **Compression test:**
The cause and the corrective measure must match each other.

8.4.1 **Possible cause:**	8.4.2 **Corrective measure:**
• Blown cylinder head gasket. ✓	• Replace cylinder head gasket. ✓
• Warped cylinder head. ✓	• Skim the cylinder head. ✓

NOTE: Any 1 cause with any 1 matching corrective measure. (2)

8.5 **Cylinder leakage test:**

8.5.1 **Listening for a hissing sound at the exhaust:**
To determine if there is a leak from the exhaust valve. ✓ (1)

8.5.2 **Checking for bubbles in the radiator:**
- To determine if the cylinder head gasket is blown/damaged. ✓
- To determine if the cylinder head is cracked. ✓
- To determine if the cylinder block is cracked. ✓

(Any 1 x 1) (1)

8.5.3 **Connect the adaptor hose:**
- To allow air to enter the cylinder. ✓ (1)

8.6 **Oil pressure test:**

8.6.1 **Too thick oil:**
High oil pressure ✓ (1)

8.6.2 **Oil pressure relief valve stuck open:**
Low oil pressure ✓ (1)

8.6.3 **Blocked oil filter:**
Low oil pressure ✓ (1)

8.7 **Electrical faults causing low fuel pressure:**
- Low voltage to the fuel pump ✓
- Defective fuel pump relay ✓
- Faulty fuel pump ✓
- Low battery voltage ✓
- Faulty ECU program ✓

(Any 3 x 1) (3)

8.8 **Radiator cap pressure test:**

Step 1: Obtain the release pressure on the cap or from manufacturer's specifications. ✓

Step 2: Fit the radiator cap with the correct adaptor on the cooling system pressure tester. ✓

Step 3: Now pump the tester while watching the release pressure on the gauge. ✓

Step 4: Check that the cap holds the specified pressure. ✓ (4)

[23]

QUESTION 9: SYSTEMS AND CONTROL (AUTOMATIC GEARBOX) (SPECIFIC)

9.1 **Torque converter:**

9.1.1 **Engaging of lockup clutch:**

- The pressurised oil in the torque converter is channelled to the lock-up clutch friction plate. ✓
- The friction plate pushes against the clutch friction surface attached to the housing. ✓
- Since the friction plate is splined to the impeller, it connects the impeller and turbine. ✓
- The turbine and impeller begin to turn as one. ✓ (4)

9.1.2 **Function of the stator:**

- Redirects oil ✓ back to the impeller. ✓
- Increases/Multiplies the engine torque. ✓✓

(Any 1 x 2) (2)

9.1.3 **Advantages of using torque converters:**

- Reducing shock loads and vibration on the transmission and drive train. ✓
- Increased load moving capacity. ✓
- Easier to navigate tight spaces and park at low-speed. ✓
- Reduced engine braking. ✓
- Reduced driver fatigue as no clutch control is needed. ✓

(Any 2 x 1) (2)

9.2 **Brake band:**

9.2.1 **Labelling:**

A. Band adjuster ✓
B. Anchor ✓
C. Lever ✓
D. Brake band ✓ (4)

9.2.2 **Purpose of brake band:**

The brake band holds the drum/annulus in a stationary position ✓ to change to another ratio. ✓ (2)

9.3 **Forward reduction:**

- The annulus is locked ✓ with the sun gear as driving component ✓ and the planet carrier as driven component. ✓
- The sun gear is locked ✓ with the annulus as driving component ✓ and the planet carrier as driven component. ✓

(Any 1 x 3) (3)

9.4 **P-position selected:**

- A parking pawl is engaged to prevent the gearbox from turning. ✓
- The engine can be restarted in P-position. ✓
- Prevent vehicle from moving. ✓

(Any 1 x 1) (1)

[18]

QUESTION 10: SYSTEMS AND CONTROL (AXLES, STEERING GEOMETRY AND ELECTRONIC) (SPECIFIC)

10.1 **Features steering system:**

- Desirable steering ✓
- Good wheel tracking ✓
- Better road-holding ✓
- Improved fuel economy ✓
- Even tyre wear ✓
- Reduced wear on the suspension ✓

(Any 2 x 1) (2)

10.2 **Effects of imbalanced wheel:**

- Wheel shimmy ✓
- Wheel bounce ✓
- Uneven tyre wear ✓
- Poor ride ✓
- Wear on the suspension ✓
- Reduced traction ✓

(Any 2 x 1) (2)

10.3 **Positive camber labels:**

A. Centre line of wheel ✓
B. Positive camber angle ✓
C. Strut ✓
D. Lower control arm ✓ (4)

10.4 **Purpose of the wheel alignment angles:**

10.4.1 **Positive caster:**
Positive caster gives a self-centring action to the steering ✓ and keeps the wheels in the straight-ahead position. ✓ (2)

10.4.2 **King pin inclination (KPI):**
King pin inclination (KPI) is designed to bring the front wheels back to the straight-ahead position after cornering ✓ without any driver effort. ✓ (2)

10.5 **Piezo injector:**

10.5.1 **Labels:**
A. Fuel return ✓
B. Piezo stack ✓
C. Nozzle/Spray holes ✓ (3)

10.5.2 **Criteria that determine the efficiency of an injector:**
- Precise fuel flow rate ✓
- No leakage ✓
- Good linearity ✓
- Low noise ✓
- Wide active range ✓
- Durability ✓
- Good spray characteristics ✓

(Any 2 x 1) (2)

10.6 **Air induction system:**

10.6.1 **Labels:**
A. Mass air flow/MAF ✓
B. Throttle body ✓
C. Air intake chamber ✓ (3)

10.6.2 **Purpose of the air-induction system:**
The air-induction system measures ✓ and controls the air required for the combustion. ✓ (2)

10.7 **Diesel particulate filter (DPF):**
It is a filter that converts particulate matter or soot ✓ into ash. ✓ (2)

10.8 **Charging system:**

10.8.1 **Functions of the slip-ring and brush assembly:**
Provides a movable connection in order to allow battery current to pass ✓ to the rotor, to produce an electro magnet. ✓ (2)

10.8.2 **Methods to increase the output frequency of the alternator:**
- Increase the turns of wire on the stationary coil. ✓
- Increase the magnetic fields. ✓
- Increase the rotational frequency at which the magnet rotates. ✓

(Any 2 x 1) (2)

10.8.3 **Correctly tensioned fan belt:**
- Ensure the correct charging of the battery. ✓
- Prevent damage of the fan belt/fraying. ✓
- Prevent damage to the alternator bearings. ✓
- To prevent slippage of the belt. ✓

(Any 2 x 1) (2)

10.9 **Deactivate speed control:**

- Switch it off. ✓
- Apply brakes. ✓
- Depress the clutch pedal. ✓
- ECU mapping/programming. ✓

(Any 2 x 1) (2)
[32]

TOTAL: 200

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