higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

AUTOMOTIVE REPAIR AND MAINTENANCE
NQF LEVEL 4

(6021034)

22 November 2024 (X-paper)
09:00–12:00

This question paper consists of 7 pages.

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AUTOMOTIVE REPAIR AND MAINTENANCE
NQF LEVEL 4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Use only a black or blue pen.
5. $V = \frac{\pi}{4} \times d^2 \times h$ $N = 1 - \frac{1}{r^{0,4}}$
6. Write neatly and legibly.

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QUESTION 1

Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 For an engine to perform optimally, it means that the engine….

A Backfires on acceleration
B Compression pressure is ideal
C Sounds uneven and rough
D Compression pressure is weak

1.2 How many gear speeds could be obtained out of one epicycle gear set?

A 3
B 4
C 5
D 6

1.3 The drive side of a gear tooth on a differential crownwheel is also the …

A front side.
B concave side.
C rear side.
D convex side.

1.4 Which ONE of the following repair tools is unlikely to be used in the repair of a double reduction drive?

A Brass drift
B Valve lifter
C Micrometer
D Dial gauge

1.5 Which ONE of the following is not a multi-port fuel injection system?

A Sequential injection
B Batched injection
C acceleration injection
D Simultaneous injection

1.6 Diesel injector pumps on CI engines are driven by the …

A gear drive.
B chain drive.
C toothed belt.
D camshaft.

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1.7 Which ONE of the following statements about the hydraulic power steering is incorrect?

A Power from the engine is required to drive the pump.
B Power steering becomes light at high speeds.
C Power steering makes the vehicle more economical.
D A broken belt will cause the steering to be hard.

1.8 Which ONE of the following sensors is not a passive sensor?

A Position sensor
B Speed sensor
C Pressure sensor
D Level sensor

1.9 ONE of the safety statements listed is not related to air-conditioning systems.

A Apply a film of oil on the O-ring before tightening.
B Discharge the system only into a recovery unit.
C Make sure the vehicle is on level firm ground.
D Do not work on the system in an enclosed area.

1.10 Which ONE of the following has no influence on the traction control system?

A Throttle position sensor
B Wheel speed sensors
C ATC control valve
D ECU control module

(10 × 1) **[10]**

QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 Modern vehicle crash tests even make provision for a drop test.

2.2 A hybrid vehicle still uses a conventional 12 volt battery to start the system.

2.3 The counterweights (crank webs) on a crankshaft balance the weight of the connecting rods.

2.4 The purpose of the tiptronic transmission is to give the driver more control of the car's performance.

2.5 A power-bar is used to check the pre-load on the pinion bearings in a differential.

(5 × 1) **[5]**

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QUESTION 3

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–M) next to the question number (3.1–3.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	Double-reduction differential	A	converts a rotational output into an electrical signal
3.2	Cold-start Injector	B	measures cylinder speed
3.3	Leak-off pipe	C	pollen filter
3.4	Torque sensor	D	petrol fuel injection
3.5	Cylinder contribution test	E	prevents hydroplaning
3.6	Air purifier	F	charges the HV battery
3.7	Tyre tread design	G	helical drive gear low speed
3.8	Whiplash	H	prevents side-sliding
3.9	MG1	I	cuts the cylinders away one by one
3.10	Augmenting	J	diesel fuel injection
		K	rear-end impact
		L	returns excess fuel from the injector tip
		M	assists with a movement

(10 × 1) **[10]**

QUESTION 4

4.1 Draw a similar table in the ANSWER BOOK as indicated below. Calculate the efficiency and compression ratio for the following engine specifications and insert the values in the table in the ANSWER BOOK. Show your calculations.

N		64.15%
r	6:1	

(7)

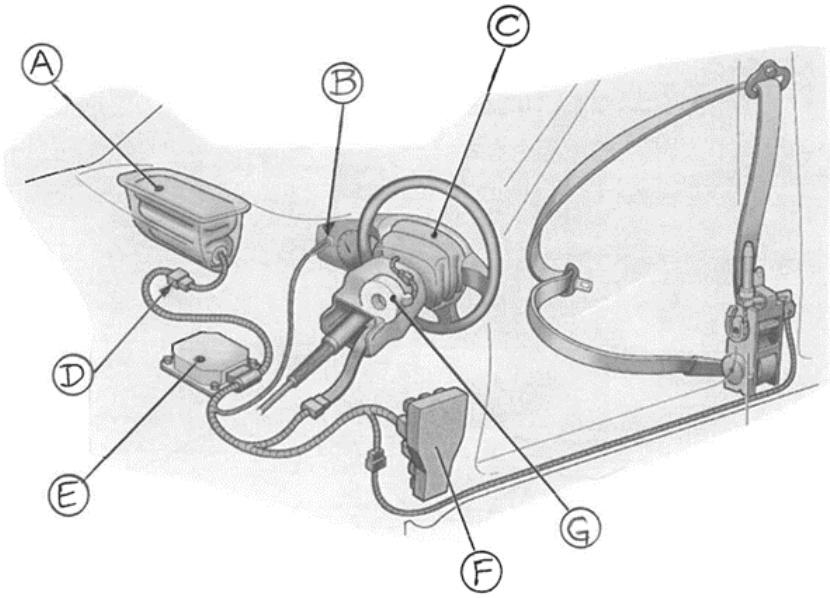
4.2 List any THREE disadvantages of epicyclic gear trains used in automatic gearboxes. (3)

4.3 List and describe the functions of the FOUR fluid coupling components. (4)

4.4 Explain the difference between a *dead axle* and *live axle*. (2)

4.5 Make a neat, labelled, freehand sketch of a gear tooth of a crownwheel showing excessive face contact. (2)

4.6 FIGURE 1 below shows a diagram of a SRS system. Name the labelled components (A–G) in the ANSWER BOOK.



(7)

FIGURE 1

[25]

QUESTION 5

5.1 On a vehicle that is not equipped with a self-diagnostic system, what in the correct procedure to follow to confirm that the electronic ignition system operates according to the manufacturer's specifications. (7)

5.2 Compile a step-by-step procedure on how to adjust the throttle cable and linkages on a diesel injection system. (7)

5.3 List EIGHT visual checks that can be performed to diagnose a faulty power-steering system. (8)

5.4 List any EIGHT reasons for problems that may occur during routine servicing on advanced electronic systems. (8)

[30]

QUESTION 6

6.1 Explain, step-by-step and in the correct sequence how to recharge an air-conditioning system with a pressure gauge manifold after the vacuum procedure is completed. (8)

6.2 Describe the working principle of the hydraulic electronic control unit (HECU) on a two diagonally split type braking system. (7)

6.3 Explain how to interpret the warning light of the SRS system on starting the vehicle. (3)

6.4 Explain how the regenerative braking system on an electric vehicle works. (2)

[20]

TOTAL: 100

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