



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

DIESEL TRADE THEORY N3

(11041823)

25 November 2022 (X-paper)

09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 7 pages.

245Q1E2225

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. Start each section on a new page.
 5. Use only a black or a blue pen.
 6. Write neatly and legibly.
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SECTION A**QUESTION 1**

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

1.1 At the end of the power stroke, the compression pressure is ... pressure.

- ☐ A higher than the initial
B lower than the initial
C the same as the initial
D higher than the combustion

1.2 Mechanical efficiency is the efficiency ...

- A with which energy is released by burning fuel.
B the amount of air passed through the engine.
C of air that can be mixed with fuel.
D of the volume of air supplied by the turbocharger.

1.3 The thermal efficiency of an engine is the ...

- A measuring of the thermal conductivity.
B ability to convert much heat to perform work.
C ability to transfer heat.
D ability to store heat.

1.4 The function of the valve springs is to ...

- A open the valves.
B close the valves.
C open and close the valves.
D lift the cam lobes.

1.5 The speed of the camshaft rotates at... the rocker shaft.

- A half the speed of
B twice the speed of
C the same speed as
D more than twice the speed of

1.6 Scavenging occurs when ...

- ☐ A both valves are open at the same time.
B only the inlet valve is open.
C both valves are close at the same time.
D only the exhaust valve is open.

1.7 The swept volume occurs when the piston moves from ...

- A BDC to TDC during the compression stroke.
- B TDC to BDC during the inlet stroke.
- C the power stroke to exhaust stroke.
- D the exhaust stroke to power stroke.



1.8 The function of the camshaft is to ...

- A drive the crankshaft.
- B open and close the valves.
- C open the valves.
- D drive the water pump.

1.9 Both valves are closed during ... the strokes.



- A exhaust and inlet
- B power and exhaust
- C power and compression
- D power and inlet

1.10 Crank radius is measured from the ...

- A diameter of the big end journal and the diameter main journal.
- B radius of the big end journal to the radius main journal.
- C centre of the big end journal to the centre of the piston.
- D centre of the main bearing journal to the centre of the piston.

(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 The function of the camshaft is to close the valves.

2.2 The pump timing gear drives the same speed as the crankshaft gear.

2.3 Incorrect valve timing has a negative effect on engine performance.

2.4 The C R on a S I engine is higher than that of an C I engine.

2.5 The belt tensioner is situated on the slack side of the timing belt.

(5 × 1)

[5]



QUESTION 3

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

COLUMN A		COLUMN B
3.1	Planetary system consists of	A chain drive
3.2	Provides momentum to engine	B impeller
3.3	Have a high mechanical efficiency	C torque multiplication
3.4	Surrounds the planetary and sun gears	D pump
3.5	Delivers fuel to the combustion chamber	E fly wheel
3.6	Keep history of work done in workshop	F ring gear
3.7	Feeds fluid to the turbine	G service records
3.8	Feeds fluid to the torque converter	H spur gear
3.9	Changes the direction of the oil flow	I receptionist
3.10	Transfer power from crankshaft to camshaft	J stator
		K injector
		L sun gears

(10 × 1)

[10]**QUESTION 4**

Complete the following paragraph regarding the operation of a hydraulic lifter by choosing a word or word(s) from the list below. Write only the word(s) next to the question number (4.1–4.5) in the ANSWER BOOK.

leakage; resistance; rotates; body; pressure; check valve; clearance; plunger; expands; forced

Oil is fed from the main oil channel through the (4.1) ... forcing the plunger away from the body. The valve lifter expands until the plunger makes contact with the valve stem and until all the (4.2) ... between the two parts has been taken up. As the cam (4.3) ..., the lifter is raised and the resistance of the valve spring closes the check valve. The oil now becomes a solid link and lifter operates as one unit. A certain amount of (4.4) ... between the body and the plunger occurs. Any oil loss is replenished from the main oil channel. The check valve is forced off its seat by the oil pressure filling the cylinder once again and the hydraulic lifter (4.5) ... to take up the valve clearance.

(5 × 1)

[5]**TOTAL SECTION A:****30**

SECTION B**QUESTION 5**

- 5.1 State FOUR important reasons of each of the following: (4)
- 5.1.1 Interference angle (4)
- 5.1.2 Valve rotation (4)
- 5.2 Give FOUR negative effects when valve clearance is too little. (4)
- 5.3 Give THREE negative effects when valve clearance is too much. (3)
- [15]**

QUESTION 6

- 6.1 Explain FOUR functions of a governor. (4)
- 6.2 State FIVE advantages of an automatic gearbox. (5)
- 6.3 List FIVE types of pressures found in a DPA pump during operation. (5)
- 6.4 Give FIVE advantages of a double overhead cam (DOHC) engine. (5)
- 6.5 Explain SIX advantages of a power steering system. (6)
- [25]**

TOTAL SECTION B: 40

SECTION C**QUESTION 7**

- 7.1 Explain how one will rectify the following excess tooth contact patterns:
- 7.1.1 Excess face contact
- 7.1.2 Excess flank contact
- 7.1.3 Excess toe contact
- 7.1.4 Excess heel contact
- (3 × 4) (12)

7.2 State the following with regard to the W-HEAD engine.

7.2.1 THREE advantages (3)

7.2.2 THREE disadvantages (3)

7.3 Calculate the unknown efficiencies in the table below by using the following formula:

$$\eta = 1 - (1/R)^{0,4}$$

N %	68,65	56,47	7.3.3	7.3.4	51,16	7.3.6
C R	7.3.1	7.3.2	11.1	14.1	7.3.5	23,56

(6 × 1)

(6)

7.4 The cylinder diameter and stroke length of an engine with a compression ratio of 15,55:1 is 75,55 mm and 10,55 cm respectively. To increase the compression ratio, 0,05 mm is machined from the cylinder block and 0,5 mm from the cylinder head.

Use the following formulae to calculate the new compression ratio after both components have been machined:

(6)

$$Cr = \frac{V_s + V_c}{V_c} ; V_s = \left[\frac{\pi D^2}{4} \right] \times L_s$$

[30]

TOTAL SECTION C: 30
GRAND TOTAL: 100