higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

DIESEL TRADE THEORY N3

(11041823)

10 August 2021 (X-paper)
09:00–12:00

Nonprogrammable calculators may be used.

This question paper consists of 8 pages.

249Q1G2110

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
DIESEL TRADE THEORY N3
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 blue pen.
6. Write neatly and legibly.

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 a power stroke, the compression pressure is …

A higher than the initial pressure.
B lower than the initial pressure.
C the same as the initial pressure.
D lower than the combustion pressure.

1.2 Mechanical efficiency occurs when burning fuel releases energy to operate …

A hydraulically.
B electrically.
C mechanically.
D pneumatically.

1.3 The efficiency of an engine is determined by the compression ratio and … efficiency.

A volumetric
B mechanical
C thermal
D electrical

1.4 During air standard efficiency (ASE), heat exchange occurs while the volume of gasses in the cylinder …

A increases.
B decreases.
C remains constant.
D is rejected.

1.5 The compression pressure in the combustion chamber starts at the …

A beginning of the compression stroke.
B end of the power stroke.
C beginning of the power stroke.
D end of the compression stroke.

1.6 Scavenging helps to cool the combustion chamber and occurs when …

A the inlet valve is open and the exhaust closed.
B both valves are closed at the same time.
C both valves are open at the same time.
D the exhaust valve is open and the inlet closed.

1.7 The distance of the throw of a crankshaft is measured from the …

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

1.8 The camshaft turns at …

A twice the speed of the crankshaft.
B the same speed as the crankshaft.
C half the speed of the crankshaft.
D the same speed as the flywheel.

1.9 The function of the camshaft is to …

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

1.10 The function of an interference angle is to …

A equalise the face and seat temperatures.
B rotate the exhaust valve.
C rotate the inlet valve.
D increase the strength of the valve.

(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 a valve spring is to rotate the valve.

2.2 The point of ignition on a diesel engine is less than 10° BTDC.

2.3 Incorrect valve timing has no effect on the injector pump timing.

2.4 The compression ratio on a diesel engine is lower than that of a petrol 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	Directs the flow of oil	A	fluid clutch
3.2	Absorbs crankshaft vibration	B	torque convertor
3.3	Gear with high mechanical efficiency	C	torque multiplication
3.4	Used in automatic transmission	D	stator
3.5	Gear with greater contact surface area	E	impeller
3.6	Grouping according to the date of service	F	flywheel
3.7	No stator present	G	annulus
3.8	Grouping according to clients' surnames	H	spur gear
3.9	Occurs during acceleration	I	helical gear
3.10	Internal teeth that mesh with planet gears	J	vibration damper
		K	alphabetical filing
		L	chronological filing

(10 × 1) **[10]**

QUESTION 4

Complete the following paragraph by choosing a word or words from the list below. Write only the answer next to the question number (4.1–4.5) in the ANSWER BOOK.

displaced; resistance; open; connected; decrease; double; closed; single; steering fluid; pressure

An engine-driven pump circulates fluid around the (4.1) … circuit of the servo mechanism and provides a build-up of hydraulic pressure when needed. As the steering is turned, the hydraulic control valve is (4.2) … by the reaction that is derived from the (4.3) … to the turning of the steering wheels by the steering-reduction gearing. The valve then allows the hydraulic pressure to a (4.4) … -acting power cylinder where thrust is developed on the side of the servo piston that is (4.5) … at some point in the steering mechanism to assist the driver's effort.

(5 × 1) **[5]**

TOTAL SECTION A: 30

SECTION B

QUESTION 5

5.1	State THREE factors that influence the power balance of an engine.	(3)
5.2.	Give THREE reasons for ensuring the correct valve clearance.	(3)
5.3	Explain the operation of an automatic gearbox to obtain the reverse gear.	(3)
5.4	Explain how the tooth contact pattern on a crown wheel is created.	(3)
5.5	Give THREE advantages of automatic transmission.	(3)
		[15]

QUESTION 6

6.1	Give FOUR mechanical reasons why an engine will have low compression.	(4)
6.2	Explain the operation of an epicycle gear when reversing.	(5)
6.3	Explain the engagement process to lock a differential.	(5)
6.4	Give FIVE advantages of a power-steering system.	(5)
6.5	Differentiate between a *common rail* and a *solid injection*. (3 + 3)	(6)
		[25]

TOTAL SECTION B: 40

SECTION C

QUESTION 7

7.1 FIGURE 1 shows a sectional view of a valve assembly.

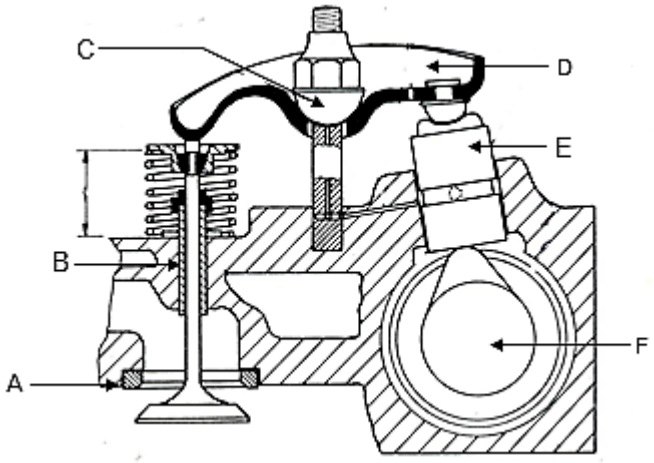


FIGURE 1

Label the parts of the valve assembly by writing only the answer next to the letter (A–F) in the ANSWER BOOK. (6 × 1) (6)

7.2 Give TWO disadvantages of a diagnostic centre from the point of view of a garage owner. (2)

7.3 List FIVE entries that must be written in a register after an accident occurred in the workshop. (5)

7.4 A diesel engine has a cylinder diameter of 118 mm and a stroke length of 169 mm.

FORMULAE: $CR = \frac{Vs + Vc}{Vc}$; $Vs = \left[\frac{\pi D^2}{4}\right] \times Ls$

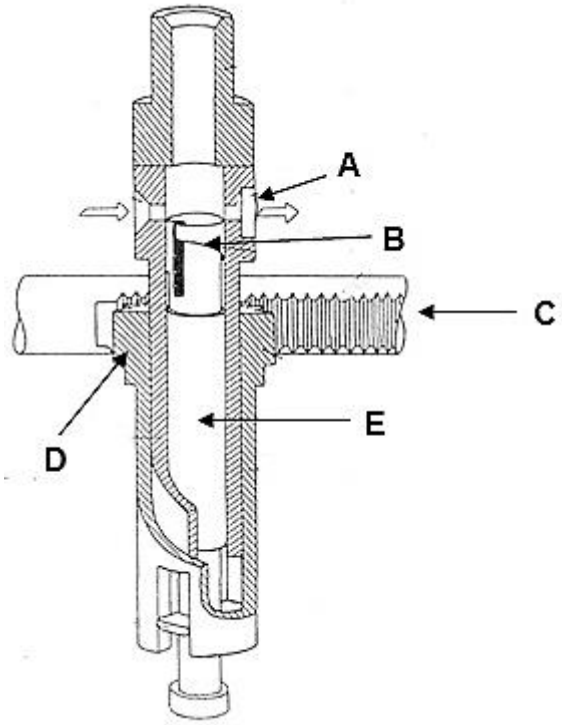
7.4.1 Calculate the swept volume of the cylinder. (3)

7.4.2 Calculate the CR in a combustion chamber of 70 cm³. (3)

7.5 An engine with a compression ratio of 8,5:1 has been machined with 1,85 mm of a cylinder head. The stroke length is 185 mm and the piston diameter is 85 mm.

Calculate the new compression ratio after the material has been removed from the cylinder head. (6)

7.6 FIGURE 2 shows a sectional view of a plunger unit.



Label the parts of the plunger unit by writing only the answer next to the letter (A–E) in the ANSWER BOOK. (5 × 1) (5)

[30]

TOTAL SECTION C: 30
GRAND TOTAL: 100