

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

**T370(E)(J22)T
AUGUST EXAMINATION**

NATIONAL CERTIFICATE

DIESEL TRADE THEORY N2

(11040192)

**22 July 2014 (Y-Paper)
13:00–16:00**

This question paper consists of 5 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
DIESEL TRADE THEORY N2
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. Write neatly and legibly.
-

QUESTION 1

1.1 There are two main types of Compression Ignition (CI) engines, namely Direct Injection models and Indirect Injection models.

1.1.1 State THREE advantages of Direct Injection engines compared to Indirect Injection engines. (3)

1.1.2 State THREE disadvantages of Direct Injection engines compared to Indirect Injection engines. (3)

1.2 Draw a neat labelled sketch of a fuel-supply system that is used on four-cylinder diesel engines.

Include the following components in the sketch:
Fuel tank, Fuel supply pipe, Water trap filter, Low pressure fuel lift pump, Secondary filter, Primary filter, High pressure fuel lines and Injectors. (8)

1.3 Name FOUR types of fuel filter materials used in diesel fuel systems. (4)

1.4 State TWO functions of the copper washer that is fitted between the injector and the cylinder head. (2)

[20]

QUESTION 2

FIGURE 1 shows a synchronising unit.
Refer to the figure and answer the questions:

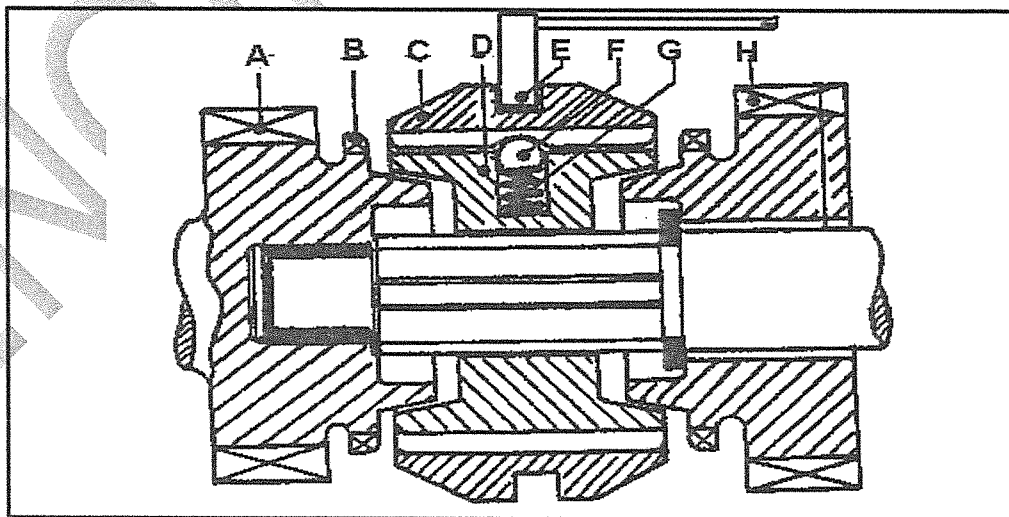


FIGURE 1

2.1 Name this synchronising unit. (1)

2.2 List the labelled parts (A–H) in your ANSWER BOOK. (8)

- 2.3 Explain the operation of this synchronising unit during gear changing. (5)
- 2.4 State FOUR functions of a gearbox. (4)
- 2.5 State ONE function of the following:
- 2.5.1 Interlocking mechanism (1)
- 2.5.2 Locking mechanism (1)
- [20]

QUESTION 3

- 3.1 State FOUR safety requirements of a steering mechanism. (4)
- 3.2 Give TWO reasons why the correct castor angle is a necessity. (2)
- 3.3 Show, by means of TWO labelled sketches, the difference between a *positive castor* and a *zero castor*. (8)
- 3.4 Name FOUR types of steering boxes used on light vehicles. (4)
- 3.5 Name the TWO types of wheel balancing methods. (2)
- [20]

QUESTION 4

FIGURE 2 below shows a final drive and differential assembly.
Refer to the figure and answer the questions:

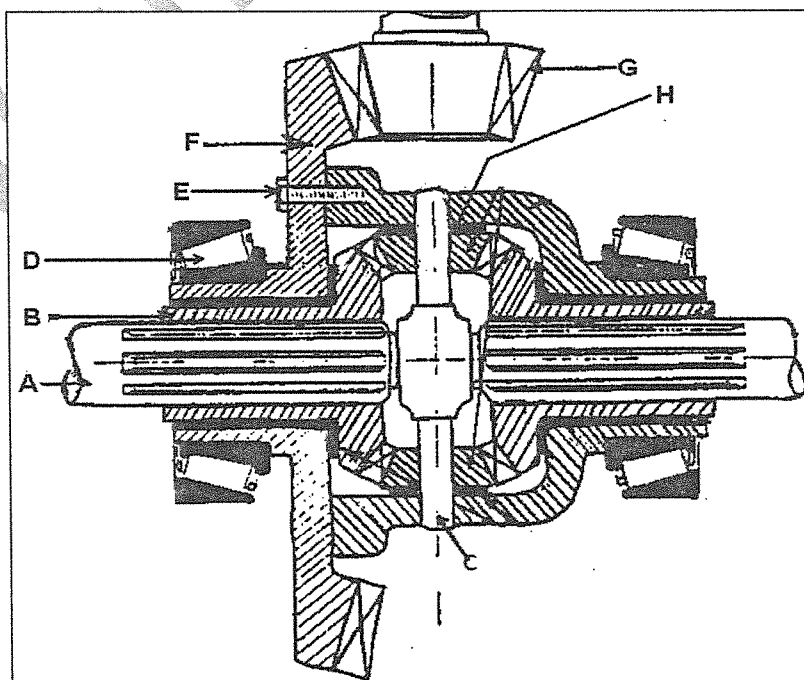


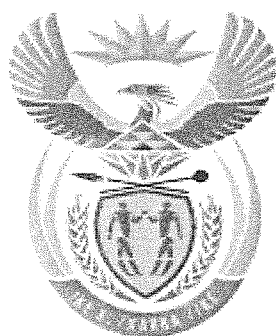
FIGURE 2

- 4.1 List the labelled parts (A–H) in your ANSWER BOOK. (8)
- 4.2 Explain the power flow through this assembly when the vehicle is moving forward. (4)
- 4.3 State TWO advantages and two disadvantages of:
- 4.3.1 Semi floating rear axles (4)
- 4.3.2 Fully floating rear axles (4)
- [20]

QUESTION 5

- 5.1 Bleeding of a braking system can be described as the removal of air from the system.
- Explain the procedure to be followed when bleeding the brakes in a hydraulic brake system. (6)
- 5.2 As a diesel mechanic it is important to identify problems in a braking system.
- Give THREE reasons for each of the following common brake problems that may occur on a vehicle:
- 5.2.1 Excessive brake pedal free play (3)
- 5.2.2 Spongy brake pedal (3)
- 5.2.3 Dragging brakes (3)
- 5.3 Name TWO types of brake callipers. (2)
- 5.4 State THREE properties of a good hydraulic brake fluid. (3)
- [20]

TOTAL: 100



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MARKING GUIDELINE

NATIONAL CERTIFICATE

AUGUST EXAMINATION

DIESEL TRADE THEORY N2

22 JULY 2014

This marking guideline consists of 7 pages.

QUESTION 1

- 1.1 1.1.1 Advantages of a direct injection engine:
- Easier starting because less heat is lost during compression stroke✓
 - Glow plugs are not required for cold starting✓
 - Increase thermal efficiency results in relatively lower fuel consumption✓

Disadvantages of direct injection engine:

- Due to increase mean effective pressure, combustion knock may occur more frequently and be more pronounced✓
- Increase injection pressure places more stress on the injector pump✓

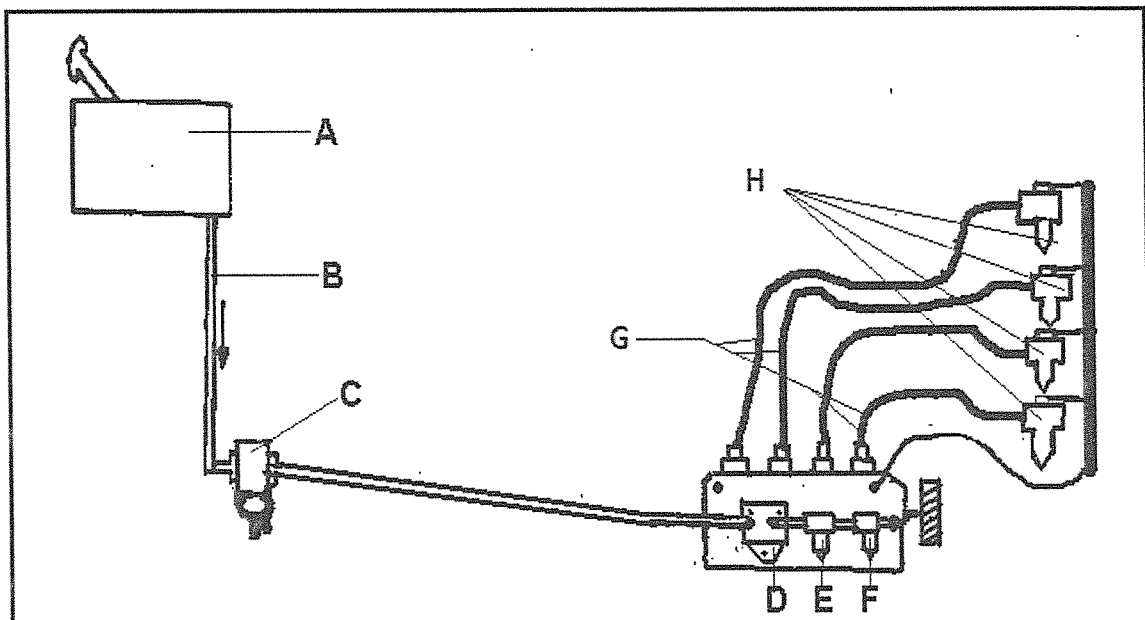
(3)

- 1.1.2 Advantages of indirect injection engine:
- The engine can attain higher revolutions and develop more power✓
 - The engine operation is smoother and less noisy.✓
 - A lower grade of fuel may be used✓

Advantages of indirect injection engine:

- Starting problems are experienced when engine is cold✓

(3)

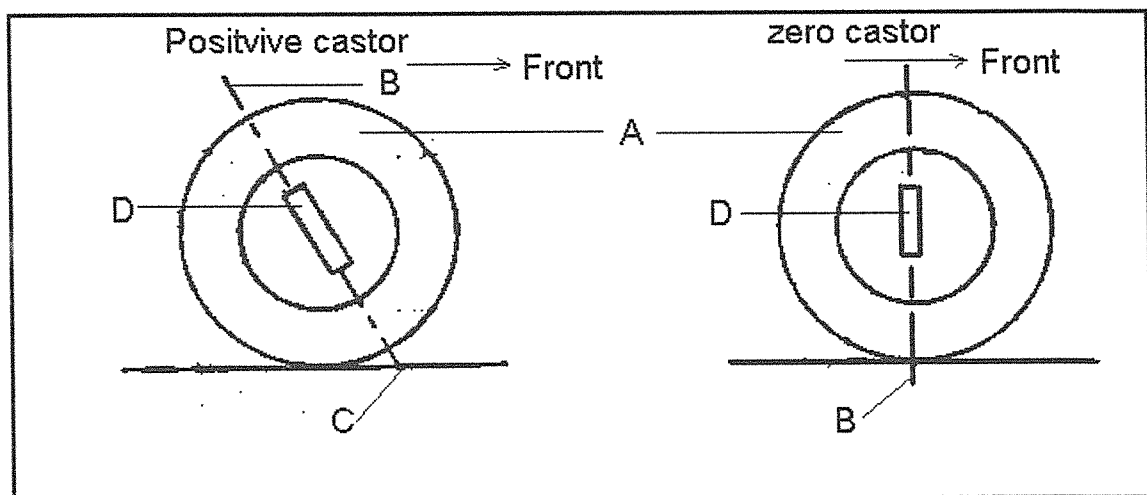
1.2 FUEL-SUPPLY SYSTEM

- 2.4
- Obtains a gear reduction to enable the vehicle to pull away from rest.✓
 - Enables the vehicle to move at high speed while engine is rotating at low revolutions.✓
 - Consists of a neutral gear that enables the engine and gearbox to disconnect from each other.✓
 - Enables the vehicle to move backward while the engine is rotating.✓
- (Any relevant answers) (4)
- 2.5
- 2.5.1 Interlocking mechanism: Prevents two gears to be selected simultaneously.✓
- 2.5.2 Locking mechanism: Prevents jumping out of gear on a gearbox.✓
- (2 x 1) (2)
- [20]

QUESTION 3

- 3.1 It must be light and easy to control.✓
The steering mechanism must be free from vibration and road shocks.✓
It must be self-centering✓ and bring the wheels back to a straight position after making a turn.✓
Suspension and braking must have little effect on a good steering system.✓
(Any relevant answers) (5)
- 3.2
- To ensure that the steering wheel turns lightly and with the same effort in both directions.✓
 - To prevent the steering wheel from picking up road shocks on uneven ground surfaces.✓
- (Any relevant answers) (2)

3.3



A = Wheel✓

B = Centre line through kingpin✓

C = Centre line at front of centre of wheel to show positive castor✓

D = Kingpin✓

(Labels: 1 mark each.)

(Sketch 4 marks correctness)

(8)

- 3.4
- Worm and sector✓
 - Worm and nut with recirculating balls✓
 - Cam and roller✓
 - Cam and lever✓
 - Worm and worm gear/rack and pinion (Any 3 x 1) (3)
- 3.5
- Static balancing✓
 - Dynamic balancing✓ (2)
- [20]

QUESTION 4

- 4.1 Advantages of semi-floating rear axles:
- Design is simple.✓
 - Manufacturing cost is comparatively low.✓
 - Assembly has comparatively low mass.✓ (Any 2 x 1) (2)
- Disadvantages of a semi floating rear axle:
- If side shaft breaks between bearing and hub wheel will fall off.✓
 - If side shaft breaks between bearing and differential, wheel will tilt and damage brake linings or shoes.✓
 - To remove or replace a side shaft, vehicle must be raised and wheel removed.✓ (Any 2 x 1) (2)
- Advantages of a fully floating rear axle:
- The bearings are set at a fair distance apart from each other, thus the load is distributed over a large area. Enables hub to carry a large mass✓.
 - The axle shaft carries no mass.✓
 - Axle shaft can be removed without raising the vehicle and removing the wheel.✓
 - If the axle is broken the vehicle can still be towed on all four wheels.✓ (Any 2 x 1) (2)
- Disadvantages of a fully floating rear axle:
- Mass more than semi-floating rear axle.✓
 - Design is complicated.✓
 - Cost to manufacture is higher.✓ (Any 2 x 1) (2)

- 4.2
- A = Side shaft left hand side
 - B = Sun gear LHS
 - C = Planetary gear cross pin
 - D = differential carrier bearings
 - E = Crown wheel carrier bolts
 - F = Crown wheel
 - G = Pinion
 - H = Thrust washers
 - I = Planetary gears
 - J = Differential carrier
 - K = Carrier bearing cup
 - L = Sun gear Right hand side
 - M = Side shaft Right hand side
- (Any 8 x 1) (8)
- 4.3
- The pinion drives the crown wheel and carrier that are bolted together.✓ The carrier is rotating the differential cross pin in a tumbling action and the planetary gears fit on this cross pin thus can turn on the cross pin.✓ The planetary gears are meshing with the sun gears that are connected with splines to the side shafts.✓ When moving straight ahead the pinion drives the crown wheel, carrier and cross pin while the cross pin tumbles the planetary gears thus driving the sun gears, thus the planetary gears and sun gears will not rotate into each other but will rotate the side shafts at equal revolutions in the same direction.✓
- (4)
[20]

QUESTION 5

5.1 Preparation

- Sufficient brake fluid must be available.
 - Brake adjustment must be carried out correctly.
 - Reservoir to be kept full at all times.
 - Check if master cylinder fitted with return valve.
 - If master cylinder is fitted with bleeding nipple, air first to be bled from master cylinder.
- (Any 3 x 1) (3)

Connect a bleeding pipe to bleeding nipple furthest from master cylinder, with free end of pipe immersed in brake fluid in jar

When a return valve is installed, the bleeding nipple is opened and brake pedal is repeatedly applied and released slowly until no air bubbles are discharged from bleeding pipe. The bleeding nipple is closed when the brake pedal is kept applied.

When no return valve is installed, the brake pedal is first applied and only then is the bleeding nipple opened. The bleeding nipple is again closed before the brake pedal reaches the end of its travel. Procedure is repeated until no air bubbles are discharged through the bleeding pipe.

(3)

5.2	5.2.1	Excessive brake pedal free play: <ul style="list-style-type: none">• Brake shoe adjustment required✓• Excessive free play between brake pedal and pushrod, or pushrod and piston in brake master cylinder✓• Insufficient brake fluid in reservoir✓	(Any 3 x 1)	(3)
	5.2.2	Spongy brake pedal: <ul style="list-style-type: none">• Air in the brake system✓• Brake shoes need adjustment✓• Brake drum is cracked✓• Brake drum or brake shoes may be oval✓	(Any 3 x 1)	(3)
	5.2.3	Dragging Brakes: <ul style="list-style-type: none">• Too tight adjusted hand brake✓• Problems with master cylinder✓• Brake fluid contamination✓• Vent hole blocked on reservoir cap✓	(Any 3 x 1)	(3)
5.3	Fixed calliper✓ Floating calliper✓			(2)
5.4	<ul style="list-style-type: none">• Must be resistant to freezing✓• Must be resistant to evaporation✓• Have a high boiling point✓• Be resistant to clogging✓• Be free of acids✓• Not have a detrimental effect on rubbers✓• Must lubricate moving parts✓• Have low viscosity✓• Be hygroscopics✓		(Any 3 x 1)	(3)
				[20]
TOTAL:				100