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Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

DIESEL TRADE THEORY N2

(11040192)

14 November 2013 (X-Paper)
09:00–12:00

This question paper consists of 9 pages.

ENGINEERING

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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. ALL sketches should be done in pencil and must be labelled.
5. Write neatly and legibly.

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QUESTION 1

FIGURE 1 shows a MECHANICAL FUEL LIFT PUMP.

Study the drawing and answer the questions.

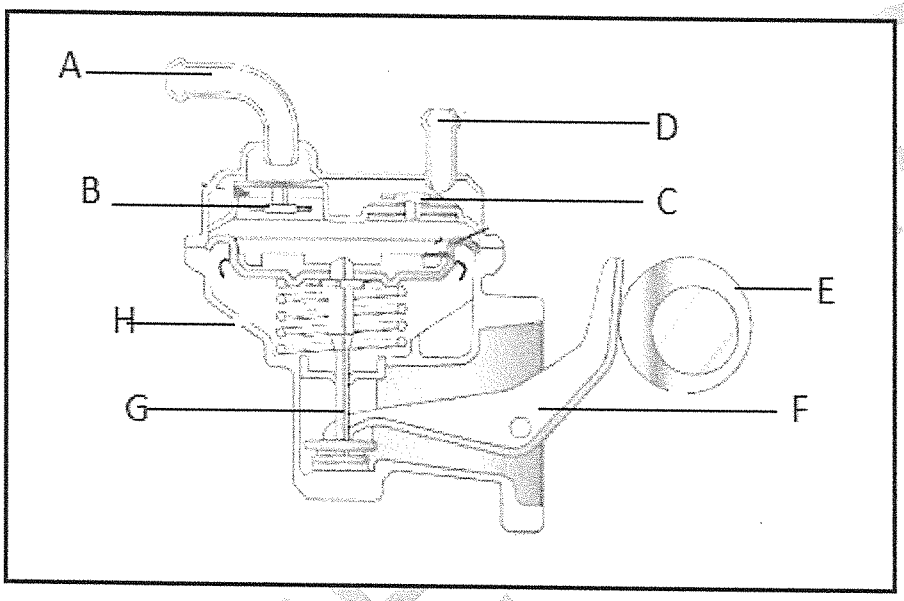


FIGURE 1

1.1 Name the indicated components by writing only the word(s) next to the letter (A–H) in the ANSWER BOOK. (8)

1.2 What is the purpose of component G on the sketch? (1)

1.3 What is the purpose of component H on the sketch? (1)

1.4 Draw a neat, labelled sketch of a fuel supply system that is used in a four-cylinder diesel engine. Also include the following labels in the sketch: 'fuel lift pump' and 'inline diesel injector pump'. Show the position of all the filters. (5)

1.5 Name THREE types of diesel fuel filter materials. (3)

1.6 Name TWO functions of the copper washer which is fitted between the injector and the cylinder head. (2)

[20]

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QUESTION 2

FIGURE 2 shows a SPRING-BLADE SYSTEM.

Study the drawing and answer the questions.

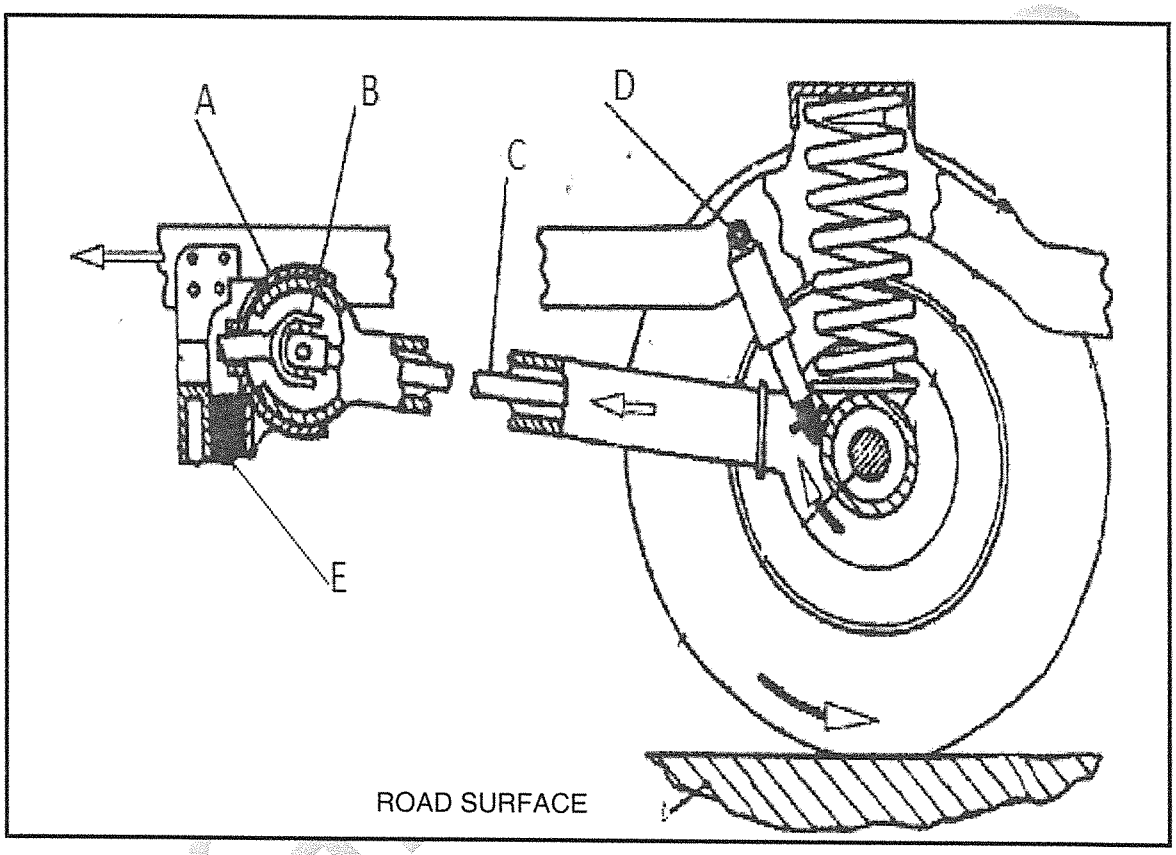


FIGURE 2

2.1 Name the indicated components by writing only word(s) next to the letter (A–E) in the ANSWER BOOK. (5)

2.2 Name the rear-wheel drive system shown in FIGURE 2. (1)

2.3 What is the function of component D on the rear-wheel drive system? (1)

2.4 What is the function of component E on the rear-wheel drive system? (1)

2.5 Name TWO functions of the centre bolt on a spring-blade system. (2)

2.6 Draw a simple, labelled sketch of a two-piece divided drive shaft that is used on trucks with a long wheel base. Show the following in the sketch: position of the gearbox housing, rear axle housing and centre bearing. (10)
[20]

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QUESTION 3

FIGURE 3 shows a GEAR LEVER SYSTEM consisting of a locking and an interlocking mechanism.

Study the drawing and answer the questions.

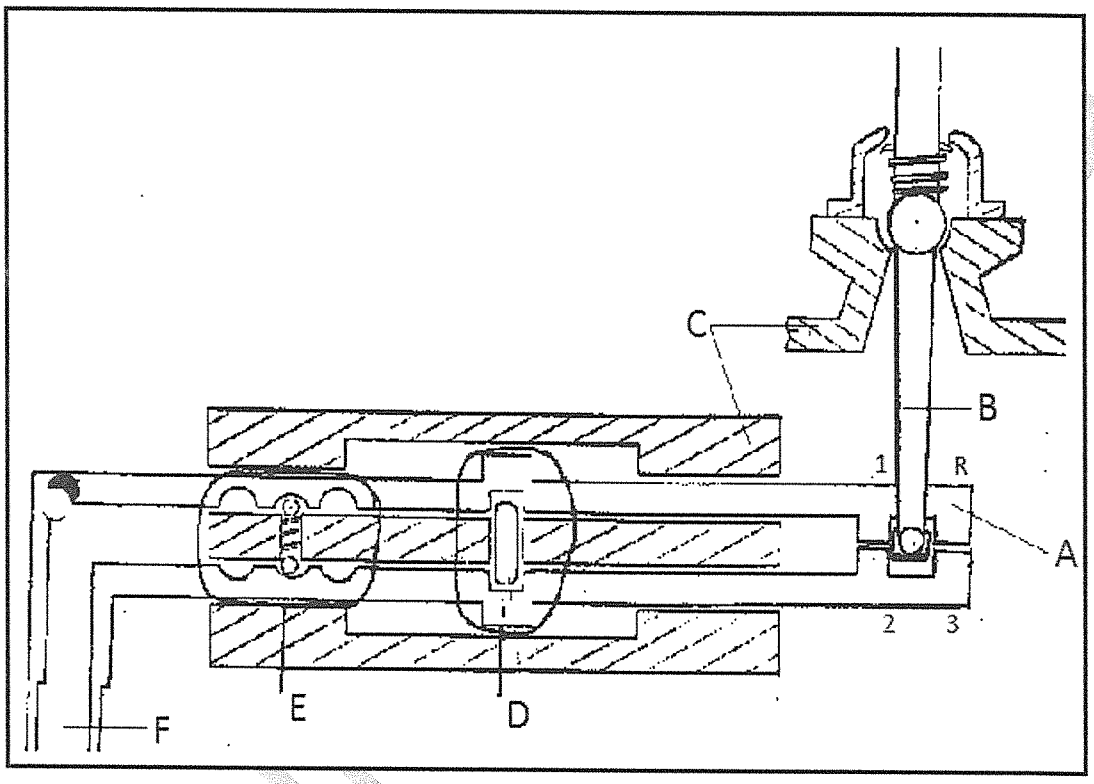


FIGURE 3

3.1 Name the indicated components by writing only word(s) next to the letter (A–F) in the ANSWER BOOK. (6)

3.2 What is the purpose of component D on the sketch? (1)

3.3 What is the purpose of component E on the sketch? (1)

3.4 State THREE reasons for using thrust washers on the main shaft of a gearbox. (3)

3.5 Which TWO types of synchronising units are used in gear boxes? (2)

3.6 State TWO functions of a gearbox. (2)

3.7 Describe how you would check the amount of oil in a gearbox. (5)

[20]

ENGLISH

QUESTION 4

FIGURE 4 shows a BRAKE BOOSTER that is used on a hydraulic braking system.

Study the drawing and answer the questions.

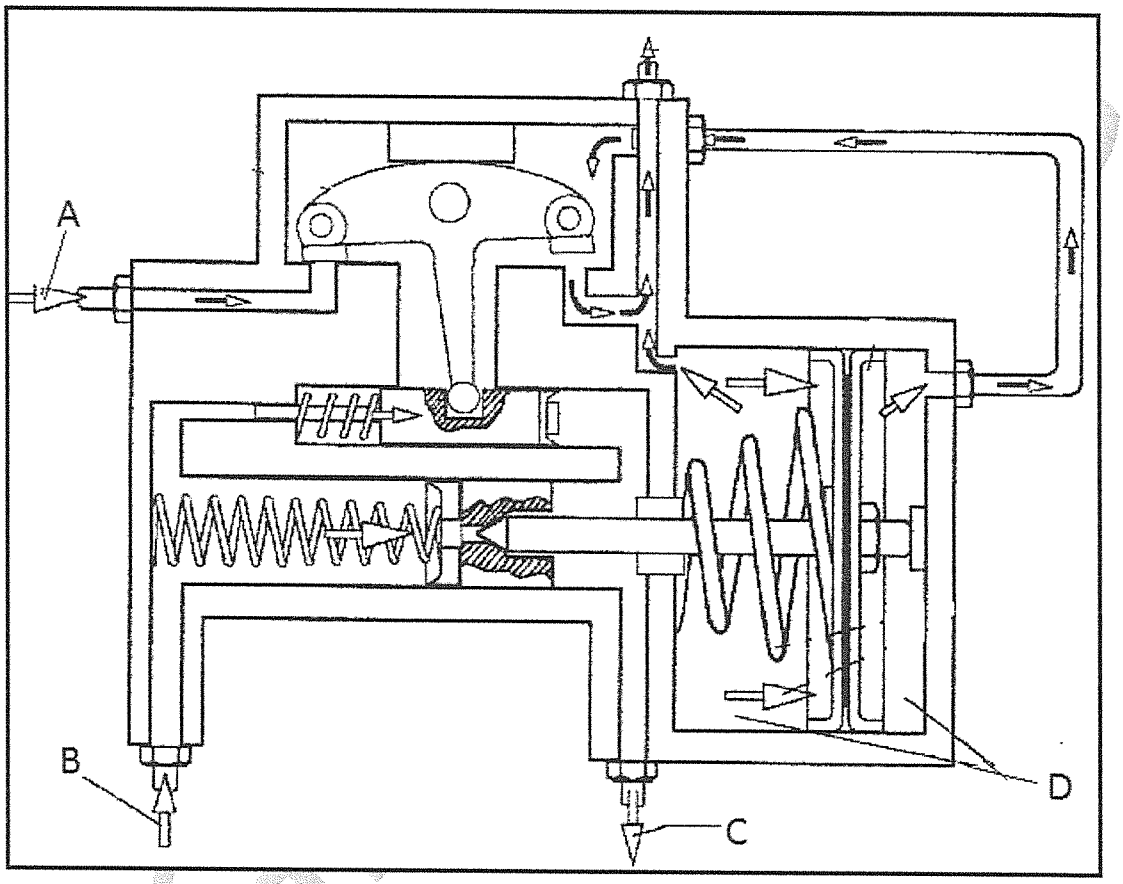


FIGURE 4

4.1 Name the indicated components by writing only word(s) next to the letter (A–D) in the ANSWER BOOK. (4)

4.2 Is the brake booster shown in FIGURE 4 in the resting or applied position? (1)

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4.3 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–E) next to the question number (4.3.1–4.3.5) in the ANSWER BOOK.

4.3.1 Why is the inner diameter of the wheel cylinders bigger than the inner diameter of the master cylinder on a hydraulic braking system?

The reason is to increase the …

A braking force.
B braking power.
C pressure on the brake shoes.
D brake pedal play.
E speeds at which the wheel cylinders push the brake shoes to the brake drums.

4.3.2 The term *hygroscopic* with reference to a brake system means the ability of the brake fluid to …

A increase the boiling point.
B decrease the freezing point.
C absorb moisture in the brake fluid.
D give good fluidity to the brake fluid.
E take dirt in the brake fluid in suspension.

4.3.3 The main advantage of a tandem brake master cylinder in contrast with a single-piston brake master cylinder is that it …

A provides more braking force on the front wheels.
B provides more braking force on the rear wheels.
C makes provision for a hand brake on the front wheels.
D acts as a safety factor when a fluid leak occurs on the brake system.
E prevents air from coming into the braking system.

4.3.4 The function of the hand brake is to …

A enable the vehicle to make handbrake turns.
B enable the vehicle to stay at rest at a slope.
C enable the vehicle to slow down more quickly in an emergency situation with the aid of the normal braking system.
D enable the inner wheel to turn slower than the outer wheel when going around a corner while the brakes are applied.
E increase the torque on the braking system.

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4.3.5 The purpose of the bleeder holes in the piston of a hydraulic brake master cylinder is to …

A prevent brake fluid from leaking out of the brake master cylinder.
B ensure that the check valve seals properly when the piston is in the resting position.
C enable sufficient free play between the pushrod and the piston.
D make sure that a predetermined amount of pressure stays in the brake pipes to ensure a positive flow of brake fluid when the brakes are applied.
E make sure that the brake fluid at the back of the piston takes up the vacuum created at the front of the piston while the piston is moving backward after the brakes are applied.

(5 × 1) (5)

4.4 What is the purpose of the brake load sensor valve? (2)

4.5 Where is the brake load sensor valve situated? (2)

4.6 Why it is necessary to change brake fluid regularly? (1)

4.7 Explain the procedure to follow when adjusting the drum brakes on trucks making use of hydraulic brakes. (5)

[20]

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QUESTION 5

FIGURE 5 shows a PINION that is used in a final drive.

Study the drawing and answer the questions.

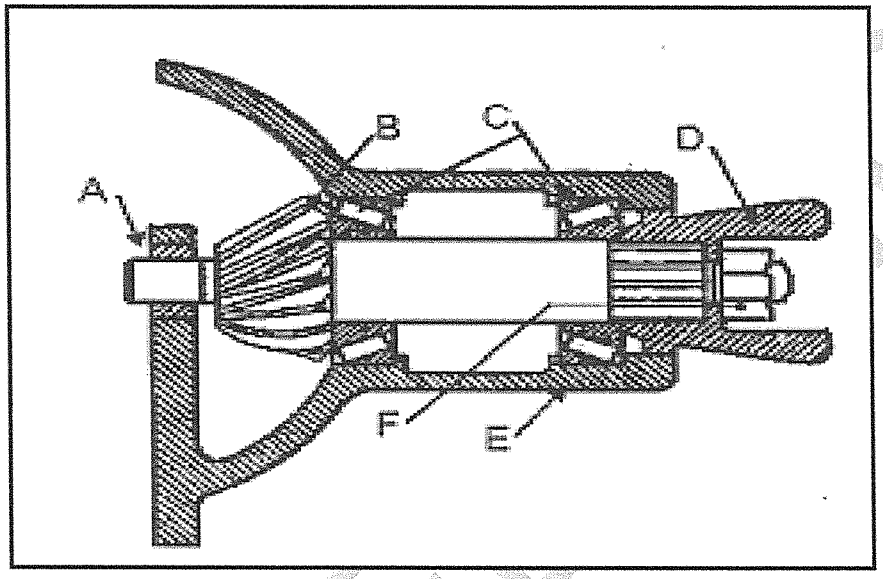


FIGURE 5

5.1 Name the indicated parts by writing only word(s) next to the letter (A–F) in the ANSWER BOOK. (6)

5.2 Explain where the pinion depth adjustment shims are fitted on the sketch. (2)

5.3 What is the purpose of the pinion depth adjustment shims? (1)

5.4 Explain where the pinion preload adjustment shims are fitted on the skecth. (2)

5.5 Give ONE reason for the use of a differential on a vehicle. (1)

5.6 Show by means of TWO neat sketches, the difference in construction between the banjo type differential housing and the built-up banjo type differential housing. (4)

5.7 State TWO advantages of the overslung worm and wheel final drive when compared with the underslung worm and wheel final drive. (2)

5.8 Name the SAE grading of the oil used in worm and wheel final drives. (1)

5.9 What material is used to manufacture a worm on a worm and wheel final drive? (1)

[20]

TOTAL: 100

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MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

DIESEL TRADE THEORY N2

14 NOVEMBER 2013

This marking guideline consists of 6pages.

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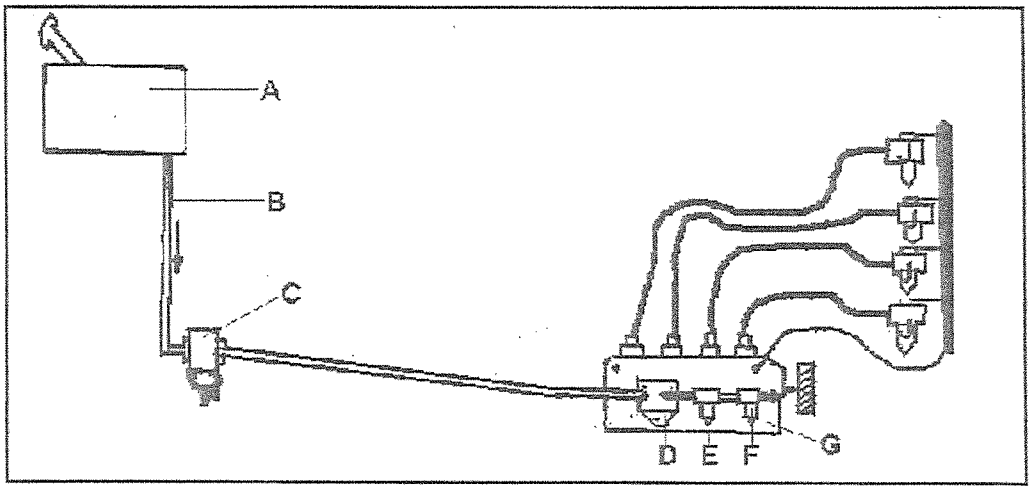
QUESTION 1

1.1
A = Fuel inlet✓
B = Inlet valve✓
C = Outlet valve✓
D = Fuel outlet✓
E = Cam rocker arm✓
F = Camshaft✓
G = Floating mechanism✓
H = Atmospheric hole✓ (8)

1.2 Allows the cam arm still to move with the camshaft while the diaphragm is stationary. This happens during periods when the engine does not need fuel from the fuel system while it is in operation. ✓ (1)

1.3 It enables the diaphragm to move up and down (breathe) through this hole while in operation (also allow the oil to leak out if seal gets worn).✓ (1)

1.4



A = Fuel tank✓
B = Fuel supply pipe ✓
C = Water trap✓
D = Fuel lift pump ✓
E = Secondary fuel filter✓
F = Primary fuel filter ✓
G = Inline Diesel injection pump ✓ (7)

1.5
- Paper maché✓
- Porous porcelain✓
- Metal plates tightened to each other ✓ (3)

[20]

QUESTION 2

2.1
A = Spherical coupling✓
B = Universal joint✓
C = Drive shaft✓
D = Shock absorber✓
E = Gearbox rubber vibration damper✓ (5)

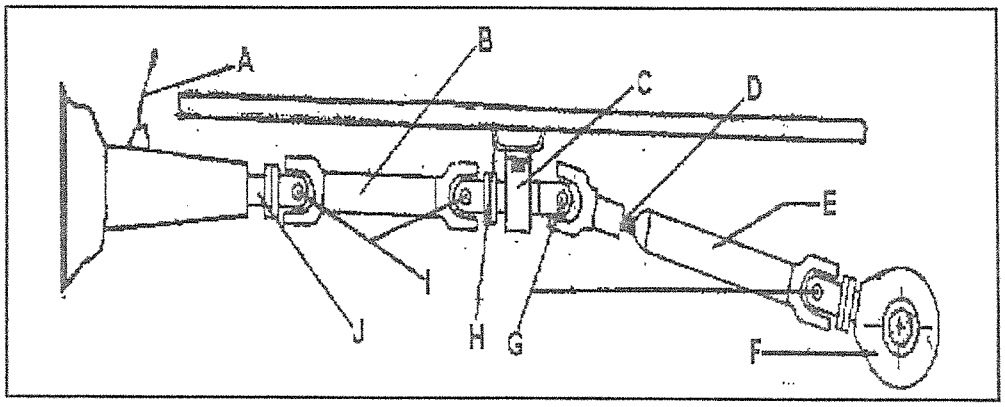
2.2 Hotchkiss drive✓ (1)

2.3 Keep the wheel on the road irrespective of the road surface. ✓ (1)

2.4 Vibration damper between the torque tube and the gearbox. ✓ (1)

2.5
- To keep the spring blades in position✓
- To keep the final drive housing in position with the chassis of the vehicle✓ (2)

2.6



SPLIT TYPE DRIVESHAFT

A = Gearlever ✓
B = Front propshaft ✓
C = Centre bearing✓
D = Slip joint✓
E = Rear propshaft ✓
F = Final drive housing✓
G = Universal joints (Hooke) at rear propshaft✓
H = Centre bearing bracket✓
I = Universal joints (Hooke) at front propshaft ✓
J = Gearbox rear flange✓ (10)
[20]

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QUESTION 3

3.1 A = Selector shafts✓
B = Gear lever✓
C = Gearbox housing✓
D = Locking mechanism✓
E = Interlocking mechanism✓
F = Selector fork✓ (6)

3.2 Prevents two gears to be selected simultaneously.✓ (1)

3.3 Ensure that the sinchro-sleeve remains in gear after gear selection.✓ (1)

3.4
- Ensure that the main shaft and cluster shaft gears are meshing properly with each other to ensure even tooth contact.✓
- Ensure proper oil lubrication between the thrust washers and the main shaft.✓
- Ensure easy gear selection during gear changing. ✓ (3)

3.5
- Constant loading type✓
- Baulk ring type✓ (2)

3.6
- Ensure sufficient torque for pulling away from rest.✓
- Ensure neutral gear selection on gearbox whilst the engine is running.✓
- Provide different gear ratios to enable high speed at low engine revolutions.✓
- Enable the vehicle to move backwards whilst the engine is rotating in the same direction✓.
- Make it possible for the vehicle to increase torque when moving up inclines. ✓

(ANY TWO/ANY OTHER RELEVANT ANSWER) (2)

3.7
- Ensure that vehicle is horizontal when checking the oil level. ✓
- Remove the filler plug.✓
- Check if oil is coming through the filler plug hole. ✓
- If not, then fill oil through the hole till the oil starts running out.✓
- Replace and tighten the filler plug to specifications. ✓ (5)

[20]

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QUESTION 4

4.1 A = Atmospheric air inlet✓
B = Brake fluid return from wheel cylinders✓
C = Brake fluid return to master cylinder✓
D = Engine intake manifold vacuum at both sides of the piston✓ (4)

4.2 Resting✓ (1)

4.3 4.3.1 A✓
4.3.2 C✓
4.3.3 D✓
4.3.4 B✓
4.3.5 E✓
(5 × 1) (5)

4.4 It increases the braking force at the rear brakes when the brakes are applied with load on the vehicle.✓✓ (2)

4.5 At the rear of the vehicle and is connected between the rear axle and the chassis✓✓ (2)

4.6 Water is absorbed by the brake fluid and can cause rust in the brake system.✓

Sludge forms in the brake fluid due to residue which can cause blockages or lessen the amount of brake fluid passing through the system.✓

Additives within brake fluid get used up during time decreasing the ability of brake fluid not to freeze at very low temperatures or to boil at very high temperatures thus decreasing the efficiency of the brake fluid.✓
(ANY ONE /ANY OTHER RELEVANT ANSWER) (1)

4.7 Jack up the wheels to be adjusted, to enable them to be turned by hand.✓
Adjust each lining by means of an adjuster. ✓
Adjust against the drum until the wheel cannot be turned by hand.✓
Loosen the adjuster until the wheel can be turned by hand.✓
Remember each wheel consists of two linings to be adjusted.✓ (5)
[20]

QUESTION 5

5.1 A = Pinion pilot bearing✓
B = Pinion ✓
C = Taper bearings✓
D = Flange✓
E = Differential housing✓
F = Preload adjustment nut✓ (6)

5.2 On the pinion shaft✓, behind the pinion gear✓ (2)

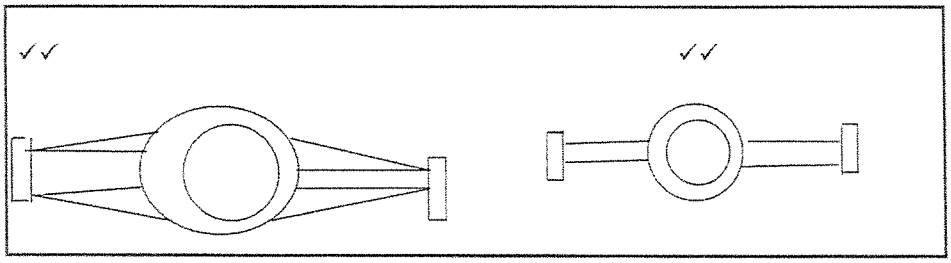
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5.3 To ensure that the pinion meshes at the correct depth on the crown wheel.✓ (1)

5.4 On the pinion shaft✓, between the flange and the bearing.✓ (2)

5.5 To ensure that the pinion does not move axially.✓ (1)

5.6



BUILT-UP BANJO-TYPE DIFFERENTIAL HOUSING BANJO-TYPE DIFFERENTIAL HOUSING (4)

5.7
- More suitable to use on tandem rear-axle drives✓
- Drive shaft is positioned further from the ground which enables vehicle to move more freely on bumpy surfaces✓ (2)

5.8 SAE 140 oil✓ (1)

5.9 Phosphorous bronze✓ (1)
[20]

TOTAL: 100

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