higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

AUTOMOTIVE REPAIR AND MAINTENANCE
NQF LEVEL 4

11 March 2020

This marking guideline consists of 5 pages.

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SECTION A

QUESTION 1

1.1 A
1.2 C
1.3 A
1.4 C
1.5 B
1.6 C
1.7 B
1.8 C
1.9 C
1.10 C

(10 × 1) **[10]**

QUESTION 2

2.1 2.1.1 False
2.1.2 False
2.1.3 True
2.1.4 False
2.1.5 False

(5 × 1) (5)

2.2 2.2.1
- The central port injection uses a central injector to spray fuel at each intake port rather than the central throttle body.✓
- The multiport injection injects fuel into intake ports just before the intake valve of each cylinder.✓

2.2.2
- Kinetic friction means the wheels lock and slide when the brakes are applied.✓
- Static friction happens when the wheels continue to rotate while braking.✓

2.2.3
- Volumetric efficiency refers to the ability of the engine to fill the engine above the piston at the end of the induction stroke.✓
- Thermal efficiency is the heat found by comparing the burned fuel and the output of the engine in kW.✓

2.2.4
- Hybrid driveline operates with electrical components.✓
- Conventional drive line works mechanically with an internal combustion engine.✓

(4 × 2) (8)

2.3 Fuel flows constantly through the injectors,✓ but at a variable flow rate.✓ (2)

2.4
- Tread design
- Braking force
- Acceleration force
- Cornering forces
- Deceleration
- Mass of the vehicle
- Wheel geometry (5)

[20]

TOTAL SECTION A: 30

SECTION B

QUESTION 3

3.1 B
3.2 E
3.3 G
3.4 F
3.5 I
3.6 M
3.7 A
3.8 D
3.9 C
3.10 J

(10 × 1) **[10]**

QUESTION 4

4.1
- Expensive
- Brake band can wear
- Additional elements required to make it more versatile

(Any relevant TWO) (2)

4.2
- Various gear ratios
- More torque can be transmitted
- Minimum wear takes place
- Quiet drive
- Gears can be changed without interrupting torque (Any THREE) (3)

4.3
- Engine power is increased
- More kW may be obtained without increased engine size
- Longer lifespan
- Reliable
- Small fire hazard
- High combustion rate
- Lower fuel consumption and high thermal efficiency
- No interference with radio signal
- Low maintenance cost because of longer intervals between service

(Any SIX) (6)

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4.4
- Throttle body injection
- Port injection
- Direct injection
- Indirect injection (4)

4.5
- Do not handle refrigerant near open flames.
- Always wear eye protection.
- Do not spill refrigerant on your skin.
- Make sure the system is fully discharged before removing any pipes.
- Never heat the service can.
- Put all used refrigerant in waste containers.
- Discharge system only into a recovery unit. (Any FIVE) (5)

[20]

QUESTION 5

5.1
- Sun gears
- Planetary carrier
- Annulus or ring gear
- Planetary gears (4)

5.2

$$Vs = \frac{\pi D^2}{4} \times Ls$$

$$= \frac{\pi \times 8{,}5^2}{4} \times 9{,}0 \checkmark$$

$$= 510{,}705 \text{ cm}^3 \checkmark$$

$$Cr = \frac{Vs + Vc}{Vc}$$

$CrVc - Vc = Vs$

$Vc(Cr - 1) = Vs$

$$Vc = \frac{Vs}{Cr - 1} \checkmark$$

$$= \frac{510{,}705}{15 - 1} \checkmark$$

$$= 36{,}479 \text{ cm}^3 \checkmark\checkmark$$ (6)

5.3 A- PINION
B- CROWNWHEEL
C- DIFF CARRIER
D- PLANET GEAR
E- SUN GEAR (5)

5.4
- Ohm meter
- Voltmeter (2)

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5.5
- Temperature sensor
- Position sensors
- Pressure sensors
- Flow sensor
- Level sensor (Any THREE) (3)

[20]

QUESTION 6

6.1 6.1.1
A – Spill port
B – Helix
C – Rack
D – Quadrant
E – Plunger

6.1.2
- The rack rotates the quadrant and plunger to rotate the helix with its longest length across the spill port to the maximum delivery position as shown in the sketch.
- Diesel fills the pump chamber through the inlet port.
- The cam of the pump shaft forces the plunger upwards.
- The helix closes the spill port and compression of the fuel takes place.
- When the pressure of the fuel exceeds the tension of the delivery the spring delivery valve opens and injection takes place.

(2 × 5) (10)

6.2
- The pump uses engine power to drive the steering oil pump.
- It is difficult to control the vehicle at high speed.
- When the v-belt snaps the steering becomes heavy.
- More oil leaks are possible.
- Often power steering becomes light at high speed with not enough road feel at the steering wheel.
- Increased complication, weight and cost.
- Increased maintenance. (Any 5 × 1) (5)

6.3
- Fill the reservoir with power steering oil.
- Start the vehicle and let the vehicle idle until the pump noises fades.
- Rotate the steering wheel from lock to lock until the noises disappear.
- Inspect the power steering oil level and top up if necessary.
- Take the vehicle for a road test. (Any relevant 5 × 1) (5)

[20]

TOTAL SECTION B: 70
TOTAL MARKS: 100

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