



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**NOVEMBER 2020**

**MECHANICAL TECHNOLOGY: AUTOMOTIVE  
MARKING GUIDELINE  
(EXEMPLAR)**

**MARKS: 200**

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This marking guideline consists of 12 pages.

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**QUESTION 1: MULTIPLE-CHOICE QUESTIONS (GENERIC)**

- 1.1 D ✓
- 1.2 C ✓
- 1.3 A ✓
- 1.4 C ✓
- 1.5 A ✓
- 1.6 C ✓
- 1.7 D ✓
- 1.8 C ✓
- 1.9 B ✓
- 1.10 B ✓
- 1.11 B ✓
- 1.12 D ✓
- 1.13 C ✓
- 1.14 C ✓
- 1.15 D ✓
- 1.16 C ✓
- 1.17 B ✓
- 1.18 A ✓
- 1.19 A ✓
- 1.20 D ✓
- 1.21 B ✓
- 1.22 C ✓
- 1.23 D ✓
- 1.24 C ✓
- 1.25 C ✓

(25 x 1) [25]

**QUESTION 2: SAFETY (GENERIC)****2.1 Examination procedure**

- Environmental observation ✓
- Visible signs and symptoms ✓
- Indicators to diagnosis ✓
- Vital functions ✓

(Any 4 x 1) (4)

**2.2 Recommendations for the application of first aid**

- The person applying first aid should remember his/her limitations. ✓
- If possible, take away the cause to avoid further injuries. ✓
- Determine the state of shock and treat the patient if necessary. ✓
- If clothes must be removed, respect the person's privacy. ✓
- Ensure the injured person is comfortable. ✓
- Call an ambulance or the doctor as soon as possible. ✓
- Do not use sticky/gypsum plaster on the wound. ✓
- Avoid using an oily substance or lotion on the wound. ✓
- Cool wound with cold water. ✓
- Do not puncture the blisters. ✓

(Any 3 x 1) (3)

**2.3 Unsafe conditions**

- Insufficient light in the workshop ✓
  - Poor ventilation ✓
  - Poor workshop layout ✓
  - Overcrowding in the workshop ✓
  - Workshop with poor signs and markings ✓
  - Lack of machine guards ✓
  - Unsafe construction environment ✓
- (Any 3 x 1) (3)

**2.4 Responsibility of an employee in the workshop**

- Installation and proper maintenance of machinery ✓
  - Repairing of machinery ✓
  - Ensuring all guards are in good condition ✓
  - Stopping anyone from using faulty machines ✓
- (Any 3 x 1) (3)

**2.5 Safety precautions when using a power saw**

- See that all guards are in place. ✓
  - Ensure that the blade is fitted in the correct direction. ✓
  - Ensure there is no oil or grease around the machine. ✓
  - Select the correct blade for the job. ✓
  - Switch off the machine before changing the blade. ✓
  - Do not make adjustments while the machine is in motion. ✓
  - Clamp workpiece properly before cutting. ✓
  - A long workpiece must be supported at the ends before cutting. ✓
  - Do not leave the machine unattended. ✓
- (Any 3 x 1) (3)

**2.6 Safety precautions when handling a gas cylinder**

- Never stack cylinders on top of each other. ✓
  - Do not bang or work on the cylinder. ✓
  - Do not allow cylinder to drop. ✓
  - Do not allow oil or grease to come into contact with oxygen fittings ✓
  - All cylinders must conform to the standards set by South African Bureau of Standards (SABS). ✓
- (Any 3 x 1) (3)

**2.7 Importance of wearing a welding helmet**

- To protect your eyes from the sparks ✓
  - To protect your eyes from UV rays ✓
  - To be able to see where to weld ✓
  - To protect your eyes from the heat ✓
- (Any 3 x 1) (3)

**2.8 Safety precaution after machine operation**

- Switch the machine off. ✓
- (1)

2.9 **Internal part of a flashback arrestor**

A – Inlet filter ✓

B – Non-return valve ✓

C – Flame arrestor ✓

D – Temperature activated cut off valve ✓

(Any 4 x 1) (4)

2.10 **Bending press safety precaution**

• Check that the machine is mounted securely. ✓

• Do not exceed the indicated load limit ✓

• Use the machine only to bend metal sheet ✓

• Do not use extensions on the folder bar levers. ✓

(Any 4 x 1) (3)

**[30]**

**QUESTION 3: TOOLS AND EQUIPMENT (GENERIC)**

3.1 **Machine tool**

3.1.1 Pedestal grinder ✓

(1)

3.1.2 **Labelling parts**

A – Base ✓

B – Column ✓

C – Motor ✓

D – Hand feed lever ✓

E – Chuck ✓

F – Work table ✓

(6)

3.1.3 **Machine operations**

• Drilling ✓

• Countersinking ✓

• Spot face ✓

• Lapping ✓

• Honing ✓

• Tapping ✓

• Reaming ✓

(Any 3 x 1) (3)

3.2 **Difference between a band saw and a power saw**

Band saw blade runs in a continuous circle, ✓ while a power saw blade operation is reciprocal. ✓

(2)

3.3 **Difference between a tap and a die**

Tap cuts internal threads ✓ while die cuts external threads. ✓

(2)

3.4 **Machine tool**

3.4.1 Pedestal grinder ✓

(1)

**3.4.2 Labeling parts**

- A – Screen ✓
- B – Tool rest ✓
- C – Motor ✓
- D – Guard ✓
- E – Grinding disc ✓

(5)

**3.4.3 Machine operation**

- Grinding off unwanted part of a workpiece ✓

(1)

**3.5 Function of equipment****3.5.1 Roller machine**

- To roll sheet of metals ✓ into cylindrical shapes ✓

(2)

**3.5.2 Fly press**

- To press fit or remove parts ✓ from each other manually ✓

(2)

**[25]****QUESTION 4: MAINTENANCE (GENERIC)****4.1 Maintenance of a pedestal drilling machine**

- Verify that all guards are secure and are functioning properly ✓
- Visually check the main electrical components for damages ✓
- Confirm the availability and condition of PPE ✓
- Lubricate moving components ✓
- Use moisture penetrating oil to spray on exposed metal surface to prevent rust ✓
- Check the availability of specific tools for pedestal drill ✓
- Use the dial gauge to check run-out of spindle ✓
- Check floor space for oil contamination ✓
- Inspect the belt for wear ✓
- Ensure correct tension of belt ✓
- Check the condition of the rack and pinion mechanism and lubricate if necessary ✓
- Ensure cutting and waste materials are removed from the surface ✓
- Ensure that machines are securely mounted ✓ (Any 4 x 1) (4)

**4.2 Friction**

- It is a mechanical resistance, ✓ to the motion between two bodies. ✓

(2)

**4.3 Cooling method during drilling process**

- Using oil (squatting oil from oil can) ✓
- Use of cutting fluid ✓

(Any 1 x 1)

(1)

#### 4.4 Factors to consider when selecting drilling speed

- Type of material ✓
- Diameter of drill bit ✓
- Material which the drilling bit is made of ✓
- Firmness with which the work is clamped ✓
- Condition of the machine ✓
- Use of cutting fluid ✓
- Rate of feed ✓

(Any 4 x 1) (4)

#### 4.5 Speed of machine spindle

$$S = \frac{90}{60} \checkmark$$

$$= 1,5 \text{ r/s } \checkmark$$

$$N = \frac{S}{\pi D} \checkmark$$

$$S = \frac{1,5}{\pi \times 0,01} \checkmark$$

$$= 47,75 \text{ r/s } \checkmark \quad (4)$$

#### 4.6 Dressing grinding wheel

- Turn off the coolant pump. ✓
- Turn on the machine and allow the machine to reach the full speed of rotation. ✓
- Turn off the machine. ✓
- Apply the dressing stick to the abrasive section of the wheel with light pressure until the wheel stops rotating. ✓
- Repeat the above step until the dressing stick begins to pull into the wheel. ✓

(5)  
[20]

### QUESTION 5: TOOLS AND EQUIPMENT (SPECIFIC)

5.1 5.1.1 Torque wrench ✓ (1)

#### 5.1.2 Torque wrench applications

Torque wrench is used to tighten the following components of a vehicle

- Cylinder head bolts and nuts ✓
- Big-end bearings, bolts and nuts ✓
- Front wheel bearings and rear axle assemblies lock nuts ✓
- Automatic gearbox bolts and nuts ✓

(Any 3 x 1) (3)

#### 5.2 Vernier calliper readings.

10,2 cm ✓ (1)

#### 5.3 Functions of an outside micrometer

- To measure inside diameter ✓
- To measure thickness ✓

(2)

**5.4 Outside micrometer safety measures**

- It must only be used as an accurate measuring instrument and not as a G-clamp ✓
- The thimble ratchet must be used when taking measurement to avoid over-tightening ✓
- Plastic plates are mounted on either side of the frame to avoid body heat transmission which can cause expansion. ✓
- A 0–25 mm can only measure a workpiece of 0–25 mm. ✓
- Test for accuracy by rotating the thimble clockwise until it locks at 0 mm. An adjustment should be made if the reading is not 0 mm. ✓
- Clean and replace in its box after use. ✓
- Do not allow to drop. ✓

(Any 4 x 1) (4)

**5.5 Precision measuring tool**

5.5.1 Dial indicator ✓

(1)

**5.5.2 Functions of a dial gauge indicator**

- To determine the run-out of flywheel ✓
- To determine if the crankshaft is bent ✓
- To set up the workpiece on a lathe machine ✓
- To determine if two pieces of equipment are the same size ✓
- To measure wears between the valve stem and the valve guide ✓
- To measure and adjust backlash on final drives ✓

(Any 3 x 1) (3)

**[15]****QUESTION 6: ENGINES (SPECIFIC)****6.1 Indirect injection**

It comprises of a pre-combustion chamber ✓ normally cast into one end of the cylinder ✓ designed to promote vigorous swirling. ✓

(3)

**6.2 Advantages of indirect injection over direct injection**

- The engine can attain higher revolutions ✓
- The injection pressure is less ✓
- Less strain on the injection pump ✓
- Engine operation is smoother and less noisy ✓
- Direct injection has combustion knock sound ✓
- The injector nozzle of a direct injection is subject to wears and clogs ✓

(Any 3 x 1) (3)

**6.3 Function of an injector**

It breaks down the quantity of fuel from the injector pump ✓ and atomises it at high pressure ✓ to mix with air in the combustion chamber. ✓

(3)

**6.4 Working principles of a solenoid injector**

- When the injector is energised (electricity supplied), an electromagnetic field is developed which then moves the plunger ✓
- This opens the valve, allowing pressurised fuel to squirt out through the orifice (tiny hole). ✓
- When not energised, a spring pushes the plunger back to close the orifice (tiny hole) ✓
- The amount of plunger opening is regulated by the amount of electricity sent to the injector ✓

(4)

**6.5 Functions of camshaft**

- The cams convert the rotary movement of the camshaft into reciprocating movement of the valves. ✓
- It serves as a driving mechanism for the oil pump and distributor. ✓
- It also serves as a driving mechanism for mechanical fuel pump in some engines. ✓

(Any 2 x 1) (2)

**6.6 Advantages of overhead valve arrangement**

- The cylinder head and the valves can be removed as a single unit. ✓
- Adjustment to the valve clearance is easy because only the taper cover is removed ✓
- More efficient design of ports and manifolds is made possible ✓
- Easier lubrication as compared to a side valve engine due to pressured lubricant from the oil pump ✓
- Valves are opened efficiently ✓

(2)

**6.7 Methods of valve arrangements**

- W-arrangement ✓
- L-arrangement ✓

(2)

**6.8 Continuous variable valve timing (CVVT)**

It is a system installed on the intake camshaft of an engine, ✓ controlled by oil control valve ✓ designed to change the opening and closing time of the intake valve ✓ in relation to the engine load and speed. ✓

(4)

**6.9 Valve lead**

A valve lead when it opens before the piston reaches TDC or BDC. ✓✓

(2)

**[25]**



**QUESTION 7: SYSTEMS AND CONTROL (SPECIFIC)**

- 7.1 7.1.1 **Diagram identification**  
Differential ✓ (1)
- 7.1.2 **Components of a differential (labelling)**  
A – Pinion gear ✓  
B – Side shaft gear ✓  
C – Crown wheel ✓  
D – Planet gear shift ✓  
E – Planet gear ✓ (5)
- 7.2 **Advantages of power steering**
- Less effort is required. ✓
  - More favourable gear ratio is achieved in the steering box ✓
  - It acts as a vibration dampener ✓
  - Enables easy vehicle parking ✓ (3)
- 7.3 **Advantage of four-wheel-drive over two-wheel-drive**
- Engine power is transmitted to the front as well as the rear wheel to offer better traction in unfavourable conditions. ✓
  - The torque required to move the car from rest is distributed equally to both front and rear wheels (less load on the wheels and differentials). ✓  
(Any 1 x 1) (1)
- 7.4 **Wheel slip**  
It is the relative motion between the wheel and the road ✓ when the force applied to the wheel exceeds the traction available on the tyre. ✓ (2)
- 7.5 **Number of differentials in a four-wheel-drive**  
2 differentials ✓ (1)
- 7.6 7.6.1 **Spark plug parts labelling**  
A – Terminal ✓  
B – Porcelain isolator ✓  
C – Metal casing ✓  
D – Earth electrode ✓  
E – Central electrode ✓  
F – Spark plug cap ✓ (6)
- 7.6.2 **Function of a spark plug**  
It provides a gap in the combustion chamber over which a high tension spark from ignition coil may jump to ignite the compressed air fuel mixture in the cylinder. ✓✓ (2)
- 7.7 **Firing order of a six-cylinder V-engine**  
1-4-2-6-3-5 ✓ (1)

- 7.8 **Number of cylinders**  
4 cylinders ✓ (1)
- 7.9 **Function of a distributor**  
It directs high voltage from the ignition coil to the various spark plugs in a predetermined firing order. ✓✓ (2)
- [25]

**QUESTION 8: MAINTENANCE (SPECIFIC)**

- 8.1 **Oil pump**  
Gear pump ✓ (1)
- 8.2 **Gear pump components (labelling)**  
A – Casing ✓  
B – Gear ✓  
C – Outlet port ✓  
D – Inlet port ✓ (4)
- 8.3 **Types of oil pumps**  
• Vane pump ✓  
• Rotor pump ✓ (2)
- 8.4 **Function of a gasket**  
Gaskets are placed between two surfaces to prevent leakage of gas, water, oil and petrol. ✓✓ (2)
- 8.5 **Places where gaskets are applied**  
• Cylinder head ✓  
• Intake and exhaust manifold ✓  
• Oil pump ✓  
• Fuel pump ✓  
• Water pump ✓ (Any 2 x 1) (2)
- 8.6 **Types of lubrication**  
• Full-film lubrication ✓  
• Boundary lubrication ✓ (2)
- 8.7 **Function of oil seal**  
Oil seal prevents the leakage of oil or grease, ✓ as well as preventing water or dust from penetrating the engine. ✓ (2)
- [15]

**QUESTION 9: FORCES (SPECIFIC)****9.1 Compression ratio**

$$\text{Swept volume} = \frac{\pi D^2}{4} \times L$$

$$\text{Swept volume} = \frac{\pi 9,0^2}{4} \times 6,5 \checkmark$$

$$= 413,512 \text{ cm}^3 \checkmark$$

$$\text{Compression ratio} = \frac{SV + CV}{CV} \checkmark$$

$$= \frac{413,512 + 69}{69} \checkmark$$

$$= 7 : 0 \checkmark$$

(5)

**9.2 Torque**

It is a twisting effect applied to a body, ✓ that tends to make the body to turn about its axis of rotation. ✓

(2)

**9.3 Torque created by piston**

The force from the linear movement of the piston ✓ is transferred through the connection to the crankshaft ✓ which changes the linear motion of the piston to rotary motion and in turn the engine torque is created. ✓

(3)

**9.4 Torque**

$$\text{Torque} = F \times r \checkmark$$

$$= 300 \times 0,5 \checkmark$$

$$= 150 \text{ Nm} \checkmark$$

(3)

**9.5 Indicated power**

It is a measure to determine the power developed, ✓ by the burning of fuel within the cylinder of an engine. ✓

(2)

**[15]**

**QUESTION 10: TERMINOLOGY(SPECIFIC)****10.1 Job card****Replace the following**

- Upper control arms ✓
- Lower ball joint ✓
- Rear-wheel bearings ✓
- Tie rod ends ✓
- Followed by an alignment ✓

(Any 3 x 1) (3)

**10.2 Quality control**

Upon the completion of work, the workshop foreman takes the vehicle for a test drive to ensure that everything on the job card has been done properly. ✓✓

(2)  
**[5]****TOTAL: 200**