LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

[redacted]

GRADE 11

MECHANICAL TECHNOLOGY: AUTOMOTIVE

NOVEMBER 2022

MARKS: 120

TIME: 3 HOURS

This question papers consists of 12 pages and 2-page formula sheet

Instructions and information

Write your centre number and examination number in the space provided on the ANSWER BOOK.

1. Read ALL the questions carefully.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Start EACH question on a NEW page.
5. Show ALL calculations and units. Round off final answers to TWO decimal places.
6. Candidates may use non-programmable scientific calculators and drawing instruments.
7. The value of gravitational acceleration should be taken as 10 m/s^2.
8. All dimensions are in millimetres, unless stated otherwise in the question.
9. Write neatly and legibly.
10. A formula sheet is attached at the end of the question paper.
11. Use the criteria below to assist you in managing your time.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS (GENERIC)

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (1.1–1.20) in your ANSWER BOOK, for example 1.21 A

1.1 In terms of the Occupational Health and Safety Act, what safety measure is applicable when the bench grinder is used?

A The tool rest must not be more than 3 mm away from the grinding wheel surface.
B Remove all guards before grinding.
C Grind on the side of the grinding wheel.
D The grinder can be forced to grind thick metal. (1)

1.2 Which ONE of the following safety procedures is applicable when using the drill press?

A Leave the chuck key in the chuck.
B Do not hold small work pieces by hand, use a machine vice.
C The drill bit can be adjusted while the machine is in motion.
D Always use goggles with dark lenses to protect your eyes. (1)

1.3 What safety measure is applicable when using the angle grinder?

A Do not force grinding.
B Guards can be removed while cutting materials.
C The machine can be used in wet conditions.
D Always wear goggles with dark lenses to protect your eyes. (1)

1.4 What colour is the acetylene gas cylinder?

A Red
B Black
C Green
D Maroon (1)

1.5 What substance is used for the operation of a pneumatic system?

A Oil
B Fuel
C Air
D Electricity (1)

1.6 What will be the tap drill size for a M10 x 1,5 screw thread?

A 10 mm
B 11,5 mm
C 8,5 mm
D 10,5 mm (1)

1.7 What is the function of an angle grinder?

A To do precision grinding of a surface
B To sharpen drill bits
C To grind off sharp edges
D To grind a perfect flat surface (1)

1.8 Which drilling machine is used for heavy drilling processes?

A Portable drilling machine
B Sensitive drill press
C Upright drill press
D Radial drilling machine (1)

1.9 What is a guillotine used for in the mechanical workshop?

A To roll sheet metal
B To bend sheet metal
C To cut sheet metal
D To join sheet metal (1)

1.10 A hydraulic press employs the principle of the multiplication of a force within a closed system by using …

A air under pressure
B fluid under pressure
C electric current
D lever advantage (1)

1.11 Which ONE of the following methods is used to reduce friction between two moving parts?

A Use two different types of metal

B Increase the temperature between the two metals
C Add abrasives to the contact area
D Increase the speed (1)

1.12 Which ONE of the following is a cause of excessive wear of the belt on the belt drive of a pedestal drilling machine?

A Lack of lubrication
B Misalignment of the pulleys
C Frequent change of speed
D Continuous drilling procedures (1)

1.13 Lack of lubrication in any type of machinery is caused by…

A overloading.
B low operating speed.
C undercutting.
D high volatility. (1)

1.14 Which ONE of the following fluids can be used to reduce friction in mechanical machinery?

A Water
B Grease
C Thinners
D Anti-freeze fluid (1)

1.15 A lack of maintenance on the bench grinder will result in …

A inaccurate grinding results.
B sharp edges on the work piece.
C insufficient lubrication of the grinding wheel.
D high speed grinding. (1)
[15]

QUESTION 2: SAFETY (GENERIC)

2.1 After welding a joint it needs to be grinded with an angle grinder to obtain a smooth surface. State TWO safety measures to observe before switching on the angle grinder. (2)

2.2 Give TWO reasons why it is important to wear a welding helmet during arc welding. (2)

2.3 State TWO safety rules to apply when using a portable hand drill machine. (2)

2.4 What safety rule must be adhered to after working procedures on any machine have been completed? (1)

2.5 State TWO safety rules one must adhere to before switching on the horizontal band saw. (2)

2.6 What safety precaution should be adhered to when drilling a small work piece on a drill press? (1)

2.7 State TWO safety rules to be observed when using a hydraulic press. (2)

2.8 Name TWO types of personal protective equipment (PPE) needed when using gas welding equipment. (2)

2.9 Why are you only allowed to light the acetylene with a flint lighter, not with a match or cigarette lighter? (2)

[16]

QUESTION 3: TOOLS AND EQUIPMENT (GENERIC)

3.1 FIGURE 3.1 below shows a type of cutting machine. Answer the questions that follow.

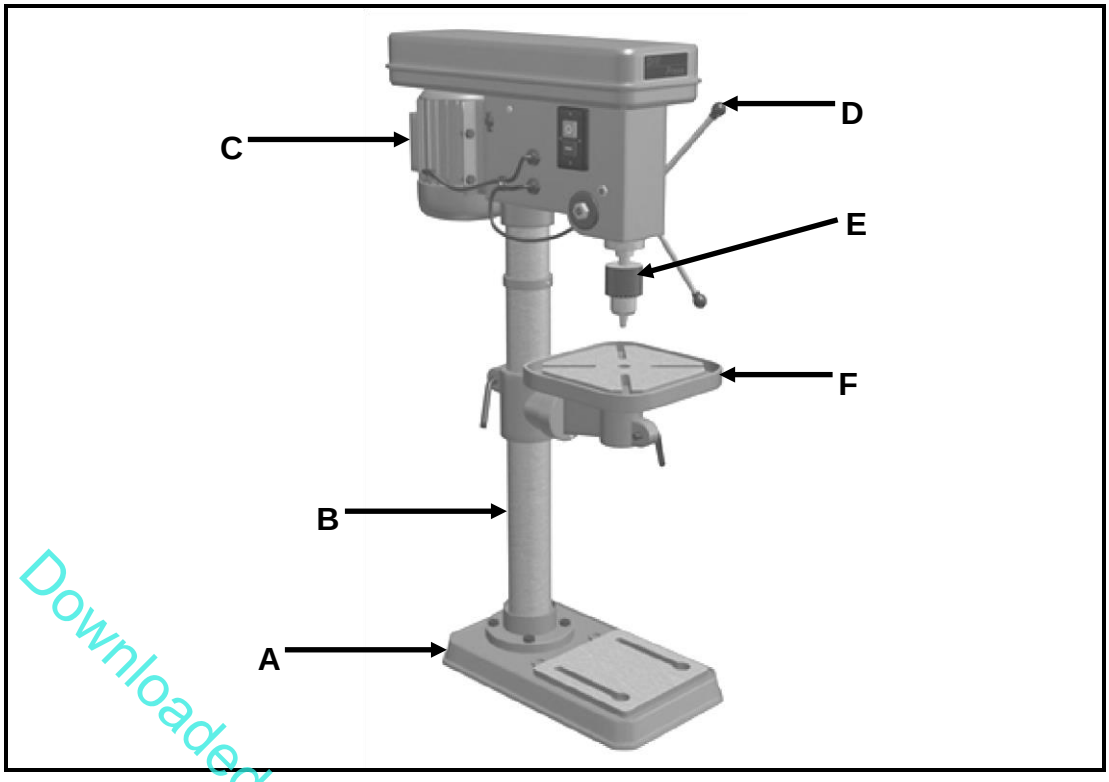

FIGURE 3.1

3.1.1 Identify the machine in FIGURE 3.1 above. (1)

3.1.2 Label **A**–**F**. (6)

3.2 What is the function of a tap and die set? (2)

3.3 What is the difference between a *power saw* and a *horizontal band saw*? (2)

3.4 What is the function of the following equipment?

3.4.1 Roller machine (2)

3.4.2 Hydraulic press (2)
[16]

QUESTION 4: MAINTENANCE (GENERIC)

4.1 Explain, with the aid of freehand sketches, the effect of a lubricant between two surfaces in contact. (2)

4.2 State TWO results of a lack of lubrication in a gear system. (2)

4.3 Define the term *friction*. (2)

4.4 What do you understand by the term *overloading*? (2)
[8]

QUESTION 5: TOOLS AND EQUIPMENT (SPECIFIC)

5.1 FIGURE 5.1 below shows an outside micrometer. Label **A**–**D** in the figure.

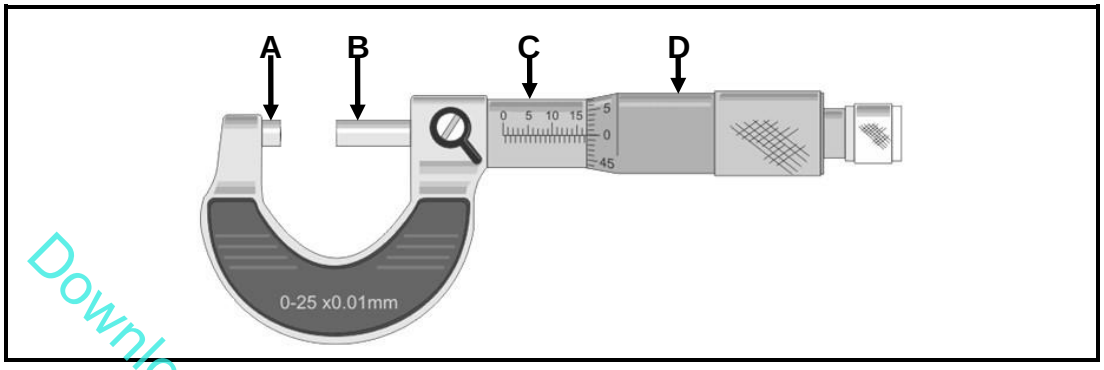

FIGURE 5.1

(4)

5.2 Give TWO reasons for using a torque wrench on an engine. (2)

5.3 Explain TWO instances where you would use a dial gauge indicator. (2)

5.4 Explain the function of a telescopic gauge. (1)
[9]

QUESTION 6: ENGINES (SPECIFIC)

6.1 What do you understand by the term *direct ignition* for a compression ignition engine? (2)

6.2 State the function of the injector in a compression ignition engine. (2)

6.3 Name TWO types of injector nozzles. (2)

6.4 Give TWO advantages of hydraulic valve lifters. (2)

6.5 Draw a valve-timing diagram for a four-stroke engine using the following information:

Inlet valve opens:	18° BTDC
Inlet valve closes:	42° ABDC
Exhaust valve opens:	48° BBDC

Exhaust valve closes: 12° ATDC
Injection: 20° ATDC (4)

Use the diagram and calculate the following:

6.5.1 Inlet-valve period (2)

6.5.2 Exhaust-valve period (2)

6.5.3 Power period (2)

6.5.4 Valve overlap (2)

6.6 Describe the purpose of the tensioner in the timing belt assembly. (2)
[20]

QUESTION 7: SYSTEMS AND CONTROL (SPECIFIC)

7.1 Identify the type of axle shown in FIGURE 7.1 below.

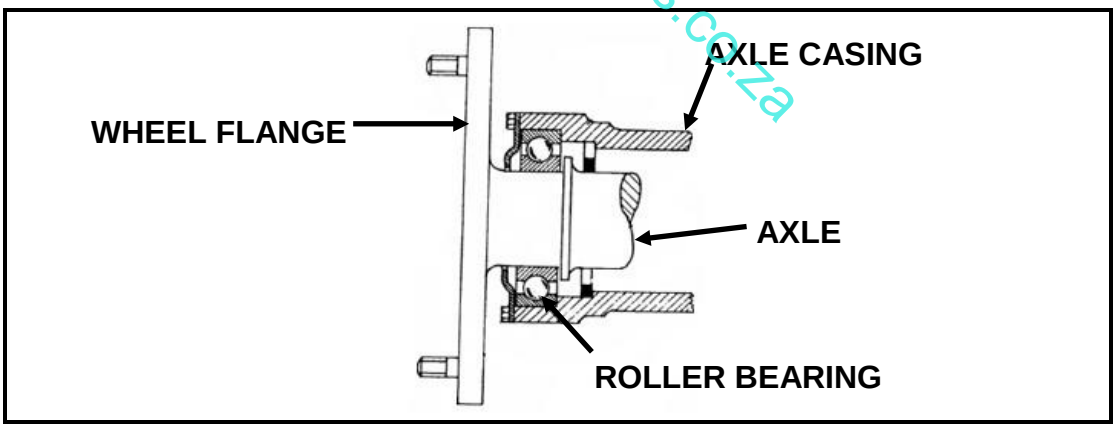

FIGURE 7.1 (1)

7.2 Describe the function of the spark plug in the ignition system of an internal combustion engine. (2)

7.3 Identify the final drive systems shown in FIGURE 15.2 and FIGURE 7.3 below.

7. 3.1

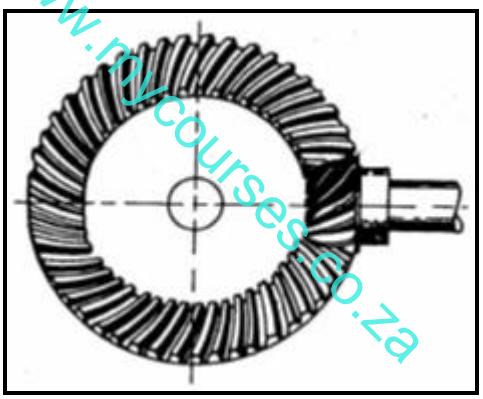

FIGURE 7. 2 (1)

7. 3.2

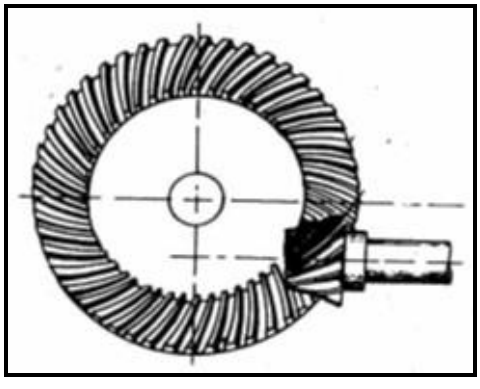

FIGURE 7. 3 (1)

7.5 Describe the purpose of the servo-brake unit. (2)

7.6 What does the abbreviation *ABS* stand for in respect of brake systems in a motor vehicle? (1)

7.8 In what type of suspension are coil springs generally used? (1)

7.9 Which suspension system unit controls the following

15.9.1 Rolling or swaying of the body (2)

15.9.2 Sideways movement of the wheels (2)

7.10 Describe the function of each of the following control systems:

7.10.1 Traction control (2)

7.10.2 Airbag control (2)

[15]

QUESTION 8: MAINTENANCE (SPECIFIC)

8.1 State the main function of an oil pump in an internal combustion engine. (2)

8.2 State THREE ways to detect oil loss in an internal combustion engine. (3)

8.3 Distinguish between TWO types of oil filtration systems. (4)

8.4 State ONE function of oil seals in a lubrication system. (1)

8.5 FIGURE 8.1 below shows a gear pump used in the lubrication system of an internal combustion engine. Briefly explain the operating principle of this pump.

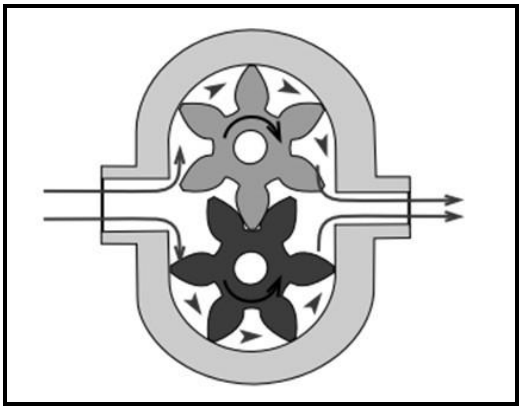

FIGURE 8.1 (3)

[13]

QUESTION 9: FORCES (SPECIFIC)

9.1 The data below refers to a four-stroke petrol engine:

Mean effective pressure: 900 kPa
Stroke length: 80 mm
Bore diameter: 90 mm
Revolutions per minute
3600r/min
Number of cylinders: 4

Calculate the *indicated power.* (8)

9.2 Calculate the compression ratio of an engine with a bore diameter of 80 mm, a stroke of 90 mm and combustion chamber volume of 50 cm^3. (5)

[13]

TOTAL **[120]**