GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

MOTOR MECHANICS SG

TIME: 3 hours

MARKS: 200

REQUIREMENTS:

- Calculator and drawing instruments

INSTRUCTIONS:

- Answer ALL the questions.
- Sketches must be neat, in good proportion and done on the right-hand page of the answer book.
- Ensure that all your answers are numbered correctly.
- An information sheet containing formulae is included.
- All sketches to be labelled.

QUESTION 1
MULTIPLE-CHOICE QUESTIONS

Each of the following questions is supplied with three possible answers of which only ONE possibility is correct. Make use of the **answer sheet** on the **inside cover** of your **answer book** and draw a cross (**X**) over the letter which, in your opinion, is the correct answer.

1.1 Aids is transferred when a person _____.

A. is kissed by an HIV positive person
B. makes contact with the body fluids of another person
C. drinks out of the cup of another (2)

1.2 Carbon monoxide is a _____.

A. colourless, odourless and tasteless gas
B. colourless, highly poisonous and almost odourless gas
C. gas that exists in various forms and different colours (2)

1.3 Atmospheric pressure at sea level is approximately _____.

A. 100 Pa
B. 100 kPa
C. 1 000 Pa (2)

1.4 Never work under a vehicle when the engine is running because _____.

A. the engine might overheat
B. carbon monoxide is a heavy gas
C. it is not very comfortable (2)

1.5 Petrol for use in internal-combustion engines consists of carbon and _____.

A. oxygen
B. nitrogen
C. hydrogen (2)

1.6 The force exerted on the piston crown is equal to the mean effective pressure _____.

A. minus the area of the piston crown
B. multiplied by the area of the piston crown
C. divided by the area of the piston crown (2)

1.7 The Prony brake is used to determine the _____ of an internal-combustion engine.

A. torque
B. force
C. brakepower (2)

1.8 When the combustion chamber of an engine is made smaller the _____.

A. fuel consumption will be lower
B. compression pressure will be lower
C. compression pressure will increase (2)

1.9 Mechanical unbalance is caused in an internal-combustion engine when _____.

A. different size pistons are used
B. the engine is running at high revolutions
C. the engine moving parts are unbalanced (2)

1.10 Before commencing with any electric welding on a vehicle equipped with an alternator, the accumulator should be disconnected to prevent _____.

A. electric shocks
B. damage to the accumulator
C. damage to the electronic components (2)

1.11 One of the following is **not** classified as a positive-displacement blower:

A. Centrifugal-type blower
B. Vane-type blower
C. Roots-type blower (2)

1.12 The firing order for a six-cylinder in-line engine is _____.

A. 1, 4, 2, 5, 3, 6
B. 1, 4, 3, 6, 2, 5
C. 1, 5, 3, 6, 2, 4 (2)

1.13 The sender unit of the electrical temperature gauge is _____.

A. fitted to the coolest section of the cooling system
B. fitted closest to the radiator
C. fitted to the hottest section of the cooling system (2)

1.14 To obtain a high-speed gear ratio with the two-speed final drive _____.

A. the sun gear of the epicyclic gear train is held stationary
B. two components of the epicyclical gear are locked together
C. the sun gear is free to rotate around its own axis (2)

1.15 An advantage of positive camber is that _____.

A. side pressure on kingpin bushes is reduced
B. load is placed on outer wheel bearing
C. steering is more direct (2)

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QUESTION 2
ENGINE BALANCE / CI ENGINES

2.1 Draw a neat sketch of a crankshaft layout for a six-cylinder in-line engine with firing periods of 120°. (4)

2.2 Draw a neat sketch of a secondary flywheel and state the reason for its use on an engine. (12)

2.3 What causes power imbalance? (2)

2.4 Define **dynamic balance**. (3)

2.5 How are impurities and water removed from diesel fuel? (2)

2.6 Which component in the injector pump prevents dribble at the injector? (2)

2.7 Which component on the pump element is adjusted during the calibration setting on the plunger-type injection pump? (2)

2.8 Draw a neat sketch of the vane-type blower. (7)

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QUESTION 3
FUELS / CARBURETTORS

3.1 Which process is used to obtain liquid fuel from coal? (4)

3.2 What is the characteristic noise that can be heard during detonation? (2)

3.3 Define the following:

3.3.1 Volatility (2)

3.3.2 Flash point (4)

3.4 Name any FOUR additives found in liquid fuel. (8)

3.5 Draw a neat sketch of the diaphragm-type constant-vacuum carburettor. (14)
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QUESTION 4
TERMINOLOGY AND CALCULATIONS

4.1 Define the following terms:

4.1.1 Force (3)

4.1.2 Power (3)

4.2

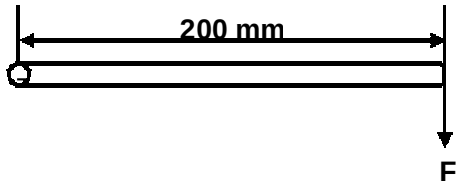

Figure 1

Calculate the force exerted on the lever in **Figure 1** if the torque is 40 Nm. (6)

4.3 Draw a typical indicator diagram for a CI engine with a compression ration of 17:1 and a maximum pressure of 9 000 kPa. (10)

4.4 Name the type of power related to theoretical power. (2)

4.5 Define the following:

4.5.1 Volumetric efficiency (4)

4.5.2 Thermal efficiency (4)

4.5.3 Mechanical efficiency (2)

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QUESTION 5
DRIVES / WHEEL ALIGNMENT

5.1 What gear ratio is obtained when the following occur in an automatic gearbox?

5.1.1 The rear clutch is disengaged and the rear brake band is free (2)

5.1.2 When the rear clutch engages the secondary sun gear to the turbine shaft (2)

5.2 State TWO functions of an automatic gearbox. (2)

5.3 Two permanent reductions in the final drive is known as _____. (2)

5.4 Explain fully the purpose of the steering box. (6)

5.5 State TWO **disadvantages** of power steering. (2)

5.6 What type of camber angle does toe-in require? (2)

5.7 State the unit that is used to measure kingpin inclination. (2)

5.8 Draw neat sketches to illustrate the following alignment angles:

5.8.1 Toe-out (5)

5.8.2 Negative castor (7)

5.9 Which alignment angle will indicate when the steering arms are bent? (2)

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QUESTION 6
ELECTRICITY

6.1 Which component in the electronic ignition system is unnecessary seeing that the contact points are not exposed to high voltages? (2)

6.2 State FOUR components in the electronic ignition system situated in the primary circuit. (4)

6.3 What is the function of the diodes in the alternator charging circuit? (2)

6.4 Indicate by means of a diagrammatic sketch how six diodes are connected in the alternator charging circuit when a y-connected stator is used. (12)

6.5 State THREE disadvantages of the alternator in comparison with the generator. (6)

6.6 Draw a neat sketch of an electrical oil-pressure sender unit. (8)
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TOTAL: 200

FORMULAE SHEET

$F = m \times a$

Work = F x distance

$T = F \times R$

$$\text{Power} = \frac{F \text{ x distance}}{\text{time}}$$

$$\text{Power} = \frac{\text{M.E.P.} \times \pi \times D^2 \text{ x stroke length x r/s x number of cylinders}}{4 \times 2}$$

$$\text{Power} = \frac{\text{M.E.P.} \times p \times D^2 \text{ x stroke length x r/s x number of cylinders}}{4}$$

IP = PLANn

Brake power = $F \times 2 \pi R \times N$

Brake power = $2 \pi NT$

$$\text{Mechanical efficiency} = \frac{\textbf{B.P.}}{\textbf{I.P.}} \times \frac{100}{1}$$

$$\text{C.R.} = \frac{SV + CV}{CV}$$

$$\text{Area} = \frac{\pi D^2}{4}$$

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

END