SENIOR CERTIFICATE EXAMINATION

FEBRUARY / MARCH

2007

MOTOR MECHANICS

SG

707-2/0 E

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10 pages

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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 two or more 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 can be prevented by _____.

A. visiting a doctor regularly
B. avoiding blood contact with another person
C. exercising regularly (2)

1.2 Petrol should be stored in a / an _____.

A. steel container that does not seal properly
B. plastic container with a proper seal
C approved fuel container (2)

1.3 To be able to switch on a transistor, current should flow through the _____.

A. collector
B. base
C. emitter (2)

1.4 The first step in the refining process of crude oil is to _____.

A. heat the oil
B. heat the oil under pressure to above 400°C
C. separate the various fractions (2)

1.5 The air / fuel ratio for maximum power is _____.

A. 12:1
B. 17:1
C. 8:1 (2)

1.6 The advantage of the constant-vacuum carburettor is having _____.

A. fewer moving parts with more circuits
B. more moving parts with fewer circuits
C. increased volumetric efficiency (2)

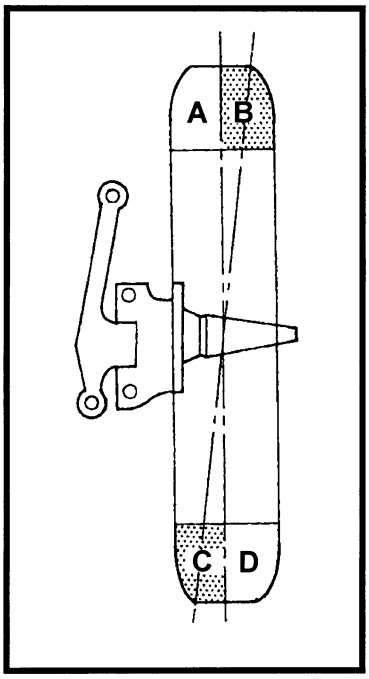
1.7 The bi-metal strip consists of _____.

A. copper and aluminium
B. copper and stainless steel
C. None of the above. (2)

1.8 The purpose of the damper piston in the constant-vacuum carburettor is to _____.

A. ease the upward movement of the vacuum piston
B. keep fuel flow constant during acceleration
C. control the sudden upward movement of the vacuum piston during the acceleration (2)

1.9



The sketch shows a wheel-and-tyre assembly which is _____.

A. statically unbalanced
B. statically balanced but not dynamically balanced
C. None of the above. (2)

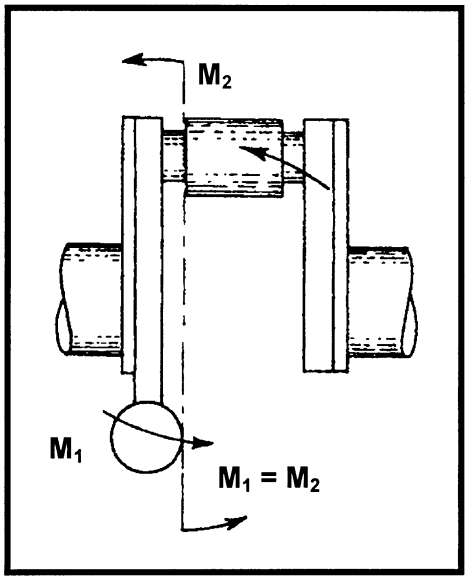
1.10 The capacitor in the electronic ignition system is redundant because _____.

A. the reverse current is too high
B. the contact points are exposed to low current flow
C. the contact points are only exposed to alternating current (2)

1.11 To change alternating current into direct current in an alternator charging circuit _____ are used.

A. 6 transistors
B. 6 diodes
C. None of the above. (2)

1.12



The sketch shows a crankshaft which is _____ balanced.

A. statically but not dynamically
B. dynamically but not statically (2)

1.13 The purpose of a blower is _____.

A. to fill the cylinder with an increased initial pressure that is higher than atmospheric pressure
B. to fill the cylinder with an air charge at atmospheric pressure (2)

1.14 Liquid fuels for use in internal-combustion engines originate from _____.

A. oil tankers
B. refineries
C. None of the above. (2)

1.15 The catalytic cracking process makes use of a _____.

A. catalyst together with high pressure
B. catalyst together with heat and pressure
C. catalyst together with heat (2)

[30]

QUESTION 2
AUTOMATIC GEARBOX / DRIVES

2.1 Explain the concept **tandem drive**. (2)

2.2 What is the advantage of tandem drive? Say what vehicle makes use of this type of drive. (2)

2.3 What type of final drive is used on a vehicle with exceptionally large drive wheels? (2)

2.4 Draw a neat sketch of a double-epicyclic gear train engaged in low gear. Show the power flow through the different gears. (12)

2.5 Which gear(s) is / are locked in the double-epicyclic gear train when second gear is engaged? (2)

2.6 Draw a neat sketch of the torque converter and show which component is responsible for causing the stator to rotate only in one direction. (14)
[34]

QUESTION 3
ELECTRICITY / INSTRUMENTS

3.1 Draw a neat sketch of a wiring circuit for an electromagnet. Show the direction of current flow as well as the direction of the magnetic lines of force. (12)

3.2 State the THREE laws of Faraday. (6)

3.3 Draw a neat sketch of the transistor that shows that the base current is interrupted with the aid of contact points. (6)

3.4

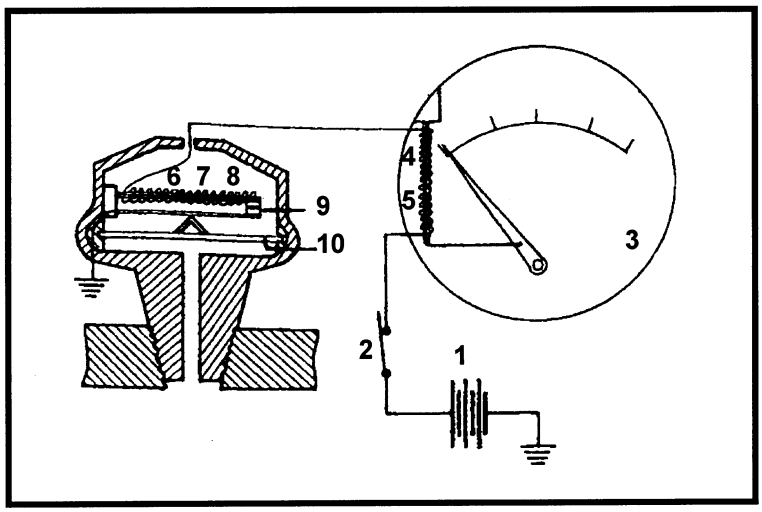


Figure 3.4

The sketch in **Figure 3.4** shows a bi-metal oil-pressure sender and an oil pressure meter when the engine is switched off. Redraw this sketch in your answer book and show high oil pressure when the engine is running. (10)
[34]

QUESTION 4
STEERING / WHEEL ALIGNMENT

4.1

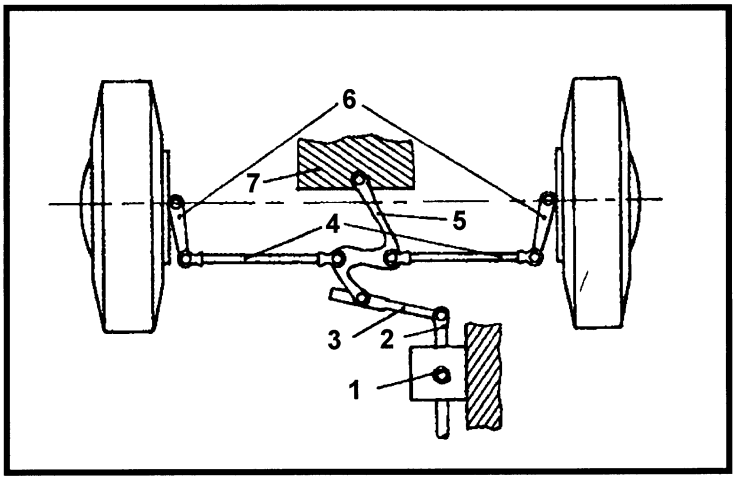


Figure 4.1

Study the sketch in **Figure 4.1** and answer the following questions:

4.1.1 What type of steering layout is shown in the sketch? (2)

4.1.2 Which components are responsible for toe-out in turns? (2)

4.2 Name TWO other steering layouts. (4)

4.3 Draw a neat sketch of the rack-and-pinion steering box. (6)

4.4 State TWO functions of the rack-and-pinion steering box. (4)

4.5 What effect will excessive toe-in have on tyre wear? (2)

4.6 Draw neat sketches of the following wheel-alignment angles:

4.6.1 Kingpin inclination with positive camber (6)

4.6.2 Positive castor (4)

4.7 Define **dynamic wheel balance**. (4)

[34]

QUESTION 5
CALCULATIONS

5.1 Draw a neat sketch of an indicator pressure diagram for a two-stroke spark-ignition engine with a compression ratio of 9:1. (6)

5.2 Define **power**. (3)

5.3 The following data refer to a five-cylinder four-stroke engine:

Mean effective pressure on a single piston	=	950 kPa
Length of stroke	=	70 mm
Cylinder diameter	=	85 mm
Revolutions per minute	=	5 400

Calculate the indicated power in kW. (12)

5.4 Calculate the compression ratio of an engine with a bore diameter of 80 mm and a stroke of 90 mm. The combustion-chamber volume is 40 cm^3. (6)

5.5 Draw a neat sketch of a piston and cylinder to show a compression ratio of 9:1. Show the clearance volume and stroke volume. (7)

[34]

QUESTION 6
FUELS / CI ENGINES

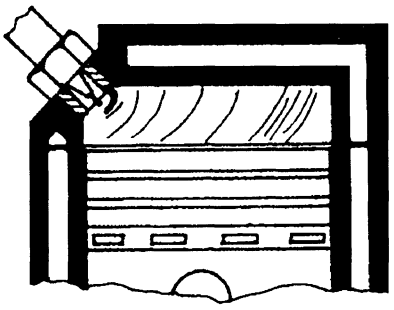


Figure A

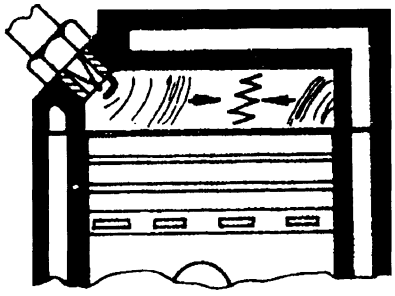


Figure B

6.1 Study **Figure A** and **Figure B** and answer the following questions:

6.1.1 What happens in **Figure A**? (2)

6.1.2 Fully explain what is happening in **Figure B**. (4)

6.1.3 What could cause the difference in the combustion processes of **Figure A** and **Figure B**? (4)

6.2 Explain why a 8:1 fuel mixture (ratio) is needed during the cold-starting period of a spark-ignition engine. (6)

6.3 What does the air / fuel ratio of 15:1 refer to? (2)

6.4 What purpose do fuel filters serve and how many are normally used on a compression-ignition engine? (4)

6.5 State TWO types of engine-speed governors currently in use. (2)

6.6 What is the purpose of an engine-speed governor? (1)

6.7 Draw a neat sketch of a centrifugal blower. (7)

6.8 State TWO advantages of a supercharger on a spark-ignition engine. (2)
[34]

TOTAL: 200

FORMULAE SHEET

$F = m \times a$

Work = F x distance

$T = F \times R$

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

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

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

IP = PLANn

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

Brake power = $2 \pi NT$

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

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

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

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

END