higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N1

(11040601)

2 August 2021 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 7 pages.

148Q1G2102

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MOTOR ELECTRICAL THEORY N1
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each question on a new page.
5. Only use a black or a blue pen.
6. Write neatly and legibly.

FORMULAE

$R_t = R_1 + R_2 + \ldots\ldots R_n$

$\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2} + \ldots\ldots R_n$

$I = \frac{V}{R}$

$P = VI$

$P = I^2R$

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 The circuit that includes the ignition system and fuel injection system is known as the …

A engine management system.
B ignition system.
C fuel injection system.
D charging system.

1.1.2 The driving force behind the flow of electricity in an electrical circuit is …

A resistance.
B static electricity.
C voltage.
D electric current.

1.1.3 This particle in an atom that carries no electrical charge:

A Proton
B Electron
C Neutron
D Ion

1.1.4 Another term for voltage is …

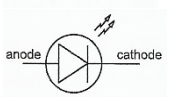
A electrical flow.
B potential pressure.
C potential difference.
D electrical current.

1.1.5 This symbol indicates a globe in an electrical circuit:

A 

B 

C 

D 

1.1.6 In a normal bar magnet, magnetic flux lines run from …

A north to south.
B south to north.
C north to the centre of the bar.
D south to the centre of the bar.

1.1.7 The component that does not form part of the primary circuit in a conventional ignition system.

A Ignition switch
B HT lead
C Condenser
D Primary coil windings

1.1.8 This component provides an air gap for the ignition spark to jump:

A Rotor
B Spark plug
C Distributor cap
D Ignition coil

1.1.9 A battery is regarded as fully discharged when the voltage across the poles is …

A 10,8 V.
B 10 V.
C 11 V.
D 0 V.

1.1.10 To measure the specific gravity of the electrolyte in a lead acid battery, one must use a …

A load tester.
B ammeter.
C voltmeter.
D hydrometer.

(10 × 1) (10)

1.2 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.2.1–1.2.10) in the ANSWER BOOK.

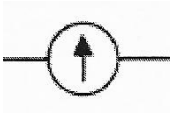
1.2.1 Maintenance free batteries do not require regular maintenance.

1.2.2 LED lights consume less power than conventional incandescent globes.

1.2.3 Parking lights are also disabled when the main relay is turned off by the ignition switch.

1.2.4 Fog lamps are traditionally used to improve visibility in snowy conditions.

1.2.5 If this warning lamp lights up, it means that the headlights are broken:



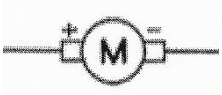
1.2.6 A Bourdon tube is used in the manufacture of both electrical and mechanical pressure gauges.

1.2.7 Fuses are built into electrical circuits to protect the circuit from overload.

1.2.8 Window demisters are regarded as auxiliary electrical equipment.

1.2.9 In light rain conditions the driver will select the intermittent function of the wipers.

1.2.10 This symbol is used to indicate an electric motor:



(10 × 1) (10)
[20]

QUESTION 2

2.1 Three cells of 3 V each are connected in series.

Calculate the total EMF over the three cells. (1)

2.2 Three resistors of 3 Ω, 5 Ω and 8 Ω are connected in series.

Calculate the total resistance offered by the resistors. (1)

2.3 Use the information in QUESTION 2.1 and QUESTION 2.2 to draw a schematic diagram. (4)

2.3.1 Determine the total current flowing through the circuit. (2)

2.3.2 Determine the voltage drop across each resistor. (6)

2.4 Name ONE type of insulator used in automotive wiring. (1)
[15]

QUESTION 3

3.1 Sketch a transistor in a common emitter configuration.

Indicate the input and output signals. (6)

3.2 List THREE properties of the transistor configuration in QUESTION 3.1. (3)

3.3 Match the test instrument with the type of battery test by writing only the letter (A–C) next to the question number (3.3.1–3.3.3) in the ANSWER BOOK.

3.3.1 Hydrometer	A Electrolyte specific gravity
3.3.2 Load tester	B Battery voltage
3.3.3 Voltmeter	C High rate discharge

(3)

3.4 Name THREE types of batteries used in automotive applications. (3)
[15]

QUESTION 4

4.1 Explain the main disadvantage of a conventional battery coil ignition system. (3)

4.2 Make a neat, labelled sketch of a conventional oil-filled coil. (7)

4.3 Explain how a high voltage spark is generated in the ignition coil. (5)
[15]

QUESTION 5

5.1 List FIVE important exterior lights on a motor vehicle. (5)

5.2 Sketch a simple electrical circuit utilising the following components:

- Pump motor
- Battery
- Ignition switch
- Pump switch
- Relay
- Fuse

(8)

5.3 Explain the operating principle of a relay. (2)
[15]

QUESTION 6

6.1 Explain the term, *reluctance*, as it applies to magnets and indicate how it can be reduced. (2)

6.2 Draw a simple bar magnet indicating the magnetic lines and direction. (4)

6.3 State the TWO most common semiconductor materials in the manufacturing of transistors. (2)

6.4 Draw a simple block diagram of an NPN transistor.

Indicate the different connections. (3)

6.5 State TWO types of reciprocating electrical petrol pumps. (2)

6.6 State TWO types of indicator flasher units. (2)

6.7 Draw a simple line diagram of a heat gauge circuit.

Include the battery and the ignition switch. (5)
[20]

TOTAL: 100