higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1180**(E)**(A4)T

NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N1

(11040601)

4 April 2019 (X-Paper)
09:00–12:00

This question paper consists of 7 pages and 1 formula sheet.

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. ALL sketches must be neat and in good proportion.
5. ALL answers including sketches must be done in the ANSWER BOOK.
6. Write neatly and legibly.

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 An electrical circuit is a …

A pathway to transport an electrical current.
B battery and switch.
C copper conductor.
D series of electrical components.

1.1.2 Resistance is the …

A promotion of current flow.
B material that prevents current flow.
C degree to which a material offers resistance to current flow.
D resistance.

1.1.3 A voltmeter is used to measure …

A electrical current.
B voltage.
C resistance.
D insulation in the circuit.

1.1.4 The two poles on a bar magnet are …

A east and south.
B north and south.
C west and south.
D west and north.

1.1.5 An electromagnet is also known as a …

A coil.
B permanent magnet.
C bar magnet.
D non-permanent magnet.

1.1.6 In the conventional coil ignition system, the points are controlled by the …

A rotor shaft.
B distributor shaft cam.
C mechanical advance unit.
D distributor cap.

1.1.7 Which gas is being released when a battery is being charged?

A Hydrogen
B Carbon dioxide
C Carbon monoxide
D Oxygen

1.1.8 A standard 12 V battery is made up of … cells.

A 12
B 4
C 6
D 24

1.1.9 The electrolyte used in a lead-acid battery is hazardous because it is …

A a chemical.
B mixed with water.
C colourless.
D corrosive.

1.1.10 Fog lights are designed to be used …

A In fog or falling snow.
B instead of the headlights.
C to blind oncoming traffic.
D for daytime visibility.

(10 × 1) (10)

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

1.2.1 The incandescent light bulb is the latest development in car lighting systems.

1.2.2 Stoplights on a vehicle are fitted to alert the drivers behind that vehicle that it is braking.

1.2.3 The filament in halogen bulbs are made of tungsten.

1.2.4 In NCT thermistors, the resistance decreases with an increase in temperature.

1.2.5 The Bauden-type pressure gauge requires electric current to function.

1.2.6 The conventional oil-pressure sensor is normally an open switch.

1.2.7 An ampmeter is used to measure current.

1.2.8 The fuel-tank float assembly incorporates a potentiometer that controls the gauge circuit current.

1.2.9 Multimeters can only measure voltage and resistance.

1.2.10 A transistor can be used as a solid state switch.

(10 × 1) (10)
[20]

QUESTION 2

2.1 Name the FIVE most common electrical circuits found on modern engines. (5)

2.2 A circuit consists of 3 resistors of 10 Ω, 15 Ω and an unknown resistor, all connected in series. The circuit is connected to a 12 V battery.

2.2.1 Make a sketch of the circuit. (3)

2.2.2 If the total current in the circuit is 0,4 A, calculate the value of the unknown resistor. (3)

2.2.3 Calculate the power consumption of the circuit. (1)

2.3 Three resistors of 5 ohms, 10 ohms and 15 ohms are connected in parallel. The circuit is connected to a 12 V supply.

2.3.1 Calculate the total resistance of the circuit. (4)

2.3.2 Calculate the current flowing in the circuit. (1)

2.4 Name THREE insulating materials used in electrical circuits. (3)
[20]

QUESTION 3

3.1 Explain the term *magnetic flux*. (2)

3.2 What is meant by *reluctance*? (1)

3.3 What happens when the two north poles of two different magnets are brought together? (1)

3.4 What type of iron is commonly used to strengthen and concentrate the magnetic flux? (1)

3.5 The main function of the distributor is to distribute the high-voltage spark to the correct cylinder.

Explain in detail how this function is performed. (8)

3.6 What is the main difference between the *conventional coil ignition system* and the *transistorised ignition system*? (3)

3.7 Name TWO types of ignition systems used in automotive engines. (2)

3.8 Differentiate between a *hot spark plug* and a *cold spark plug*. (2)
[20]

QUESTION 4

4.1 Name THREE important types of testing equipment used when testing a battery. (3)

4.2 Name the THREE main groups of car batteries. (3)

4.3 4.3.1 What is the main constructional difference between the *conventional battery* and the *low-maintenance battery*?

4.3.2 State the service intervals of the low-maintenance battery.
(2 × 1) (2)

4.4 State TWO external features of a maintenance-free battery. (2)
[10]

QUESTION 5

5.1 Choose an instrument/meter/gauge from the instrument list in COLUMN B that matches an action in COLUMN A. Write only the letter (A–G) next to the question number (5.1.1–5.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
5.1.1	Turn signals on	A	speedometer
5.1.2	Vehicle speed indication	B	revolution counter
5.1.3	Engine temperature	C	oil pressure gauge
5.1.4	Engine speed	D	temperature gauge
5.1.5	Engine oil pressure	E	indicator warning lamp
		F	high beams on warning lamp
		G	brake light switch

(5 × 1) (5)

5.2 Make a neat, labelled sketch of an oil-pressure warning-lamp circuit. (5)
[10]

QUESTION 6

6.1 Why is it not advisable to use a conventional test light on a modern vehicle? (2)

6.2 What is the function of a diode? (2)

6.3 State the THREE most common measurements that can be done with a multimeter. (3)

6.4 Explain the process of doping in semi-conductor production. (3)

6.5 Draw TWO simple sketches to show how diodes can be connected in forward and reverse bias. (4)

6.6 Explain the avalanche point of a Zener diode. (2)

6.7 Name TWO applications of a transistor. (2)

6.8 Sketch the electrical symbol of an LED. (2)

[20]

TOTAL 100

(11040601)

MOTOR ELECTRICAL THEORY N1

FORMULA SHEET

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

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

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

$P = VI$

$P = I^2R$