higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N2

(11040612)

24 November 2022 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 5 pages and 1 formula sheet.

217Q1E2224

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MOTOR ELECTRICAL THEORY N2
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. Use only a blue or black pen.
5. Sketches and graphs must be clear, neat and fully labelled. A pencil may be used.
6. Write neatly and legibly.

Copyright reserved

QUESTION 1

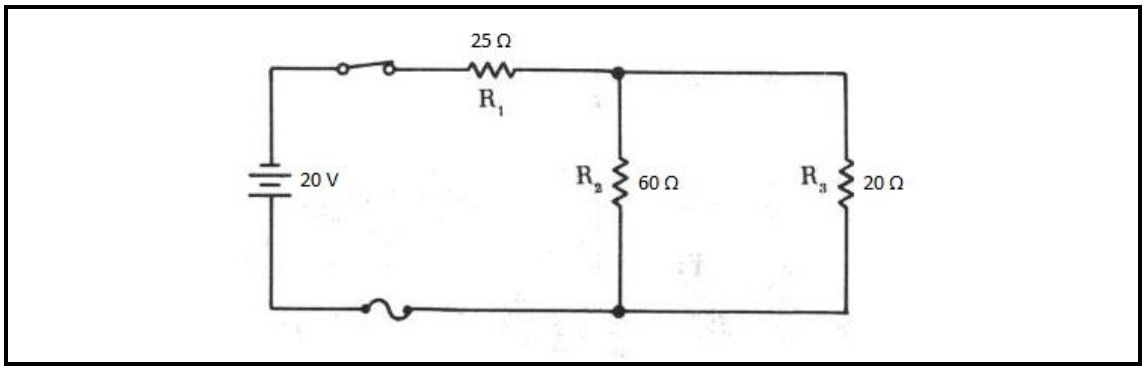
Choose a description from COLUMN B that matches an item in COLUMN A. Write only the letter (A–J) next to the question number (1.1–1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Diode	A	Controls alternator output current
1.2	Internal resistance	B	Secures the brush holder to the brush plate
1.3	Potential difference	C	Part of a stroboscopic timing light
1.4	Regulator	D	Prevents overload current through a circuit
1.5	Fuse	E	Combination of diodes that converts AC to DC
1.6	Rivet	F	Opposition of current flow due to cells
1.7	Magneto	G	Insulates commutator segments
1.8	Mica	H	Device that controls the direction of current flow
1.9	Rectifier	I	Produces a high voltage when turned
1.10	Strobe light	J	Terminal voltage in a circuit that conducts current

(10 × 1) **[10]**

QUESTION 2

2.1



The series-parallel circuit above has the following information:

$R_1 = 25\ \Omega$
$R_2 = 60\ \Omega$
$R_3 = 20\ \Omega$
The potential difference of the supply = 20 V

Calculate the following for the given circuit:

2.1.1 Total parallel resistance

2.1.2 Total circuit resistance

2.1.3 Current flow through the circuit

2.1.4 Voltage across R_3

2.1.5 Current flow through R_2

2.1.6 Power produced by R_2

(6 × 3) (18)

2.2 A circuit with two batteries with six cells each has a closed-circuit terminal voltage of 24 volts and an EMF of 28 volts. The current flow through the circuit is 20 amps.

Calculate the internal resistance per cell. The batteries are connected in series. (4)

[22]

QUESTION 3

3.1 The following component is part of a starter motor.



3.1.1 Name the component. (1)

3.1.2 Explain the function of the component. (2)

3.1.3 Name the insulating material that is found between the windings and the core. (2)

3.1.4 Name the components (not shown) that keeps the armature in a centralised, linear position. (2)

3.2 Describe the operation of a screw push-type starter motor, including how the pinion engages and turns the ring gear attached to the engine of a vehicle. (6)

3.3 Make a neat, labelled sketch of a rectangular starter motor brush that has a lead. (3)

3.4 State TWO possible causes of burnt windings in a starter motor. (2)

3.5 Explain the purpose of the overrunning clutch that is found in the drive of the pre-engaged-type starter motor. (2)

Copyright reserved

3.6 Describe the construction of the field coils of a starter motor. (4)

[24]

QUESTION 4

4.1 Explain in SIX steps the procedure that is followed to set the ignition timing of the conventional ignition system, with the use of a timing light. (6)

4.2 List FOUR safety precautions that should be observed when performing the procedure described in **QUESTION 4.1**. (4)

4.3 A magneto is an efficient device that produces a high voltage that produces a spark at the spark plug, for example in a two-stroke engine. Explain how the high voltage is produced by the magneto. (5)

4.4 Give the reason why the ignition timing of a vehicle without a distributor does not require re-setting. (2)

4.5 Name FOUR components of a conventional ignition coil. (4)

[21]

QUESTION 5

5.1 Explain the process of the filter capacitor to reduce the ripple effect from a rectifier. (4)

5.2 Neatly sketch TWO labelled diagrams to show the difference between alternating current and direct current. (2 × 2) (4)

5.3 State THREE pre-checks that should be performed on a lead-acid battery before the charging process is conducted. (3)

5.4 Name TWO types of testing equipment used for the procedures mentioned in **QUESTION 5.3.** (2)

5.5 Explain the procedure that is followed to slow-charge a lead-acid battery. (4)

5.6 Explain the correct procedure to jump-start a vehicle (A), using the power of the battery of another vehicle (B). (6)

[23]

TOTAL: 100

Copyright reserved

(11040612)

MOTOR ELECTRICAL THEORY N2

FORMULA SHEET

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

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

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

$I = \frac{E}{R+r}$

$P = VI$

$P = I^2R$

$V = E + Ir$

$E = blv \sin\theta$

$F = bli$

Copyright reserved