higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N1

(11040601)

2 August 2019 (X-Paper)
09:00–12:00

This question paper consists of 6 pages and 1 formula sheet.

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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 drawn neatly and in good proportion.
5. ALL answers including sketches must be done in the ANSWER BOOK.
6. Work neatly.

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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 ANSWWER BOOK.

1.1.1 The staring circuit ensures high amperage current to the …

A coil to produce the high-tension spark.
B starter to crank the engine.
C alternator during cranking.
D headlight circuit during cranking.

1.1.2 An ion is an atom that has …

A an electrical charge.
B a neutral charge.
C a nucleus is that is positive.
D a nucleus is that is negative.

1.1.3 The function of the fuse in a circuit is to …

A increase circuit current.
B decrease circuit current.
C protect the circuit.
D insulate the circuit.

1.1.4 In a conventional ignition system the low-tension circuit means the …

A secondary circuit.
B primary circuit.
C primary dwell angle.
D transistor circuit.

1.1.5 How many coils are combined in a coil pack used in a 4-cylinder engine?

A 4
B 2
C 8
D 1

1.1.6 The specific gravity of a fully charged battery is …

A 1,28.
B 1,15.
C 1,2.
D 1,25.

1.1.7 The latest design in headlight bulb technology is the … bulb.

A halogen
B incandescent
C twin filament
D gas discharge

1.1.8 The standard wattage of parking light circuits is …

A 10 W.
B 5 W.
C 60 W.
D 8 W.

1.1.9 Most electronic sensors are rated …

A 5 V
B 6 V
C 5 W
D 12 V

1.1.10 When diffusing P- and N-type material it forms a diode. The barrier area formed between the TWO materials is known as the … zone.

A forward bias
B reverse bias
C electrical
D depletion

(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 Electric current is the flow of electrons across conductors.

1.2.2 Copper offers the least resistance of all metals to current flow.

1.2.3 A transistor is a combination of three or more diodes.

1.2.4 Strong electromagnets can attract even nonferrous metals.

1.2.5 Good auto-electrician diagnoses and repairs electrical circuits by the trial-and-error method.

1.2.6 It is always advisable to fit a higher amperage fuse if the designated fuse continuously blows.

1.2.7 To sense the fuel level in the tank a rheostat is connected to the float.

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1.2.8 The abbreviation TPMS stands for tyre pressure monitoring system.

1.2.9 The electrolyte of the conventional lead/acid battery is a mixture of water and sulphur.

1.2.10 Diodes can be likened to electrical valves.

(10 × 1) (10)
[20]

QUESTION 2

2.1 A 24 V starter draws a current of 80 A during cranking.

Calculate the resistance offered by the starter. (2)

2.2 Draw the following electrical symbols:

2.2.1 Diode

2.2.2 Bulb

2.2.3 Transistor

2.2.4 Switch

2.2.5 Fuse

2.2.6 Relay

2.2.7 Motor

2.2.8 Battery

2.2.9 Galvanometer

2.2.10 Zener diode

(10 × 1) (10)

2.3 A parking light circuit consists of 2 bulbs of 5 W each. The globes are connected through a switch to a 12 V battery.

2.3.1 Draw the circuit. (3)

2.3.2 Calculate the total current of the circuit. (5)
[20]

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QUESTION 3

3.1 Explain the function and operation of the mechanical advance unit. (9)

3.2 Why it is important that the ignition timing be advanced according to engine load? (4)

3.3 List THREE functions of a spark plug. (3)

3.4 Draw a fully labelled sketch of a bar magnet, showing the poles and magnetic lines and their direction. (4)
[20]

QUESTION 4

4.1 All car batteries have a label indicating the amp-hour (A.h.) rating of the battery.

Briefly explain what a 45 A.h specification means. (3)

4.2 Differentiate between a *gel cell* and a *conventional lead/acid cell*. (2)

4.3 How can corrosion be removed from a battery terminal clamp? (1)

4.4 List FOUR lighting circuits in modern vehicles. (4)
[10]

QUESTION 5

5.1 State FOUR possible reasons why a heat gauge does not work. (4)

5.2 Make a neat, labelled sketch of a diaphragm-type electric fuel pump. Only sketch the electrical section of the pump. (5)

5.3 Which motorcar accessory is used to warn pedestrians of your presence? (1)
[10]

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QUESTION 6

6.1 Explain the operation of a PN-junction in reverse bias. (5)

6.2 Explain the operation of a diode connected in reverse bias. Pay special attention to the depletion zone. (3)

6.3 Make a neat, labelled sketch of a NPN-transistor. (3)

6.4 Sketch the characteristic curve of a transistor used as a switch. (5)

6.5 Show, by means of a diagram, how a diode is connected in forward and in reverse bias. (4)
[20]

TOTAL: 100

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(11040601)

MOTOR ELECTRICAL THEORY N1

FORMULA SHEET

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

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

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

$P = VI$

$P = I^2R$

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