



higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T440(E)(M30)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N1

(11041861)

30 March 2016 (X-Paper)
09:00–12:00

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

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
ELECTRICAL TRADE 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. Write neatly and legibly.
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QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1–1.20) in the ANSWER BOOK.

- 1.1 When working with dangerous liquids such as acids, rubber gloves must be worn.
- 1.2 Accidents are mainly caused by carelessness.
- 1.3 Good housekeeping cuts down the time spent looking for goods.
- 1.4 Fire protection equipment is indicated by the colour red.
- 1.5 There is no danger in forcing objects against a grinding wheel.
- 1.6 Ladders should always be of a sturdy construction.
- 1.7 To calculate electrical current, the equation used is $V = I \times R$.
- 1.8 The maximum value of a sine wave is measured at the peak of the wave.
- 1.9 In an electrical circuit, the voltmeter should always be connected in series with the load.
- 1.10 In a moving-coil instrument, the purpose of a hairspring is to bring the pointer back to the zero mark.
- 1.11 A combination of a voltmeter and an ammeter can be used to determine the resistance value of a resistor.
- 1.12 The current in an electrical circuit is directly proportional to the resistance.
- 1.13 A good conductor must be reasonably cheap.
- 1.14 There must be no openings on the sides of a conduit.
- 1.15 Earth means being so connected to the general mass of the earth as to ensure immediate discharge at all times.
- 1.16 A fault current occurs when the insulation of a conductor is damaged.
- 1.17 An ohmmeter or a buzzer can be used to test for polarity.
- 1.18 The resistance during an insulation test should not be less than 1 mega ohm.

1.19 Diodes may not be coupled directly across a supply.

1.20 Resistance values are written on resistors.

(20 × 1) [20]

QUESTION 2

2.1 Define a *flameproof appliance* or *enclosure*. (4)

2.2 Name FOUR accidents typical of poor housekeeping in a workshop. (4)

2.3 Which are the THREE elements that are present in all fires? (3)
[11]

QUESTION 3

3.1 Define *Ohm's law*. (5)

3.2 FOUR cells, each with an EMF of 1,5 V and an internal resistance of 0,4Ω, are connected in series to make up a battery. TWO resistors of 6Ω and 8Ω respectively are first connected in parallel and then across the terminals of the battery.

Draw a neat, fully labelled schematic diagram of the circuit. (5)

Making use of the data given above, calculate the following electrical quantities:

3.2.1 The total EMF of the circuit (1)

3.2.2 The total internal resistance of the circuit (1)

3.2.3 The total resistance of the circuit (5)

3.2.4 The current flowing through the cells (2)

3.2.5 The total internal volt drop (2)

3.2.6 The terminal voltage of the battery (voltage supply) (2)

3.2.7 The current flowing through each resistor (4)
[27]

QUESTION 4

- 4.1 Explain each symbol in the given formula.
Also NAME the standard unit used for each:

$$E = V + Ir$$

	SYMBOL	MEANING	STANDARD UNIT
Example	Q	Heat energy	Joule
4.1.1	E		
4.1.2	V		
4.1.3	I		
4.1.4	r		

(8)

- 4.2 Two different batteries have their cells connected in series and parallel respectively. Compare the two groups in terms of the EMF, the internal resistance, as well as current delivering capacity.

	QUANTITY	SERIES CONNECTED	PARALLEL CONNECTED
Example	Heat energy	Increases	Constant
4.2.1	EMF		
4.2.2	Internal resistance		
4.3.3	Current delivery capacity		

(6)

[14]**QUESTION 5**

- 5.1 State FOUR properties of a good insulating material. (4)
- 5.2 State TWO advantages of PVC cables. (2)
- 5.3 What does the term *earthed* mean? (5)

[11]**QUESTION 6**

- 6.1 Name THREE disadvantages of paper-insulated cables. (3)
- 6.2 State THREE conditions under which flexible metal conduit may be used. (3)
- 6.3 What is the purpose of an earth leakage unit? (3)

[9]

QUESTION 7

- 7.1 State ONE main purpose for which capacitors are used in AC circuits. (1)
- 7.2 What is the purpose of a diode? (3)
- 7.3 Two capacitors of $10\ \mu\text{F}$ and $20\ \mu\text{F}$ respectively are connected in parallel.
Calculate the total charge if a DC voltage of $100\ \text{V}$ is applied across the circuit. (4)

[8]**TOTAL: 100**

ELECTRICAL TRADE THEORY N1**FORMULA SHEET****RESISTORS**

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

$$R_T = R_1 + R_2 + R_3 + \dots$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

POWER

$$P = V \times I$$

$$P = I^2 \times R$$

$$P = \frac{V^2}{R}$$

ENERGY

$$W = P \times t$$

$$W = VI \times t$$

$$W = I^2 R \times t$$

$$W = \frac{V^2}{R} \times t$$

CELLS

$$E = V + (I \times r)$$

$$R_T = R + r$$

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

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

RESISTIVITY

$$R = \frac{\rho \times \ell}{a}$$

$$a = \frac{\pi \times d^2}{4}$$

TEMPERATURE COEFFICIENT

$$R_t = R_o(1 + L_o t)$$

TRANSFORMERS

$$\frac{V_1}{V_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$$

CAPACITORS

$$C_T = C_1 + C_2 + C_3 + \dots$$

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$$

FREQUENCY

$$f = np$$

$$f = \frac{1}{T}$$