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Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

T520(E)(A4)T

**NATIONAL CERTIFICATE**

**ELECTRICAL TRADE THEORY N1**

(11041861)

**4 April 2017 (X-Paper)**

**09:00–12:00**

**This question paper consists of 5 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

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**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. Sketches must be large, neat and fully labelled.
  5. 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 Insulation gloves are used when working with live conductors.
- 1.2 Ignorance is one of the causes of electrical accidents.
- 1.3 Good housekeeping is required because it leads to space saving.
- 1.4 Red is the basic colour used to indicate danger.
- 1.5 To cool a grinding wheel after use it can simply be dipped in water.
- 1.6 Wooden ladders should not be painted but may be treated with oil or covered with clear varnish.
- 1.7 A transformer is regarded as the most efficient electrical machine.
- 1.8 A semiconductor material has a resistivity between a good insulator and a good conductor.
- 1.9 An ammeter is connected in parallel with the load in an electrical circuit.
- 1.10 In domestic installations annealed copper is used as a conductor.
- 1.11 A coil attracts the moving iron in an attraction-type instrument.
- 1.12 The value of a resistor is accurate when a voltmeter and an ammeter are used to determine the resistance value.
- 1.13 Potential transformers are used to measure low voltages.
- 1.14 Current transformers are used to measure high current.
- 1.15 An earth continuity conductor is used to receive radio signals.
- 1.16 A circuit breaker is used to disconnect the current under normal circumstances.
- 1.17 The sensitivity of an earth leakage relay should not be higher than 30 mA.
- 1.18 A calibrated earth leakage tester can be used to determine the sensitivity of an earth leakage relay.
- 1.19 The symbol for a Zener diode is made of a cross and a triangle.
- 1.20 The value of the red band on a resistor is two.

(20 × 1) **[20]**

**QUESTION 2**

- 2.1 Tabulate the FOUR classes of fire and the type of fire extinguisher that should be used for each class. (4 × 2) (8)
- 2.2 State FIVE safety aspects that should be considered before using an extension ladder. (5)
- [13]**

**QUESTION 3**

- 3.1 3.1.1 Define *Joule's law* with regard to electricity in terms of the quantities involved. (3)
- 3.1.2 Give the symbols used for the quantities in QUESTION 3.1.1 above. (3)
- 3.2 Three resistors with values of 6 Ω, 4 Ω and 2 Ω respectively are connected in series across a 24 V supply.  
Draw a neat, fully labelled schematic diagram of the circuit. (5)
- 3.3 Use the data given in QUESTION 3.2 to determine the following electrical quantities:
- 3.3.1 The total resistance of the circuit (2)
- 3.3.2 The total current flowing through the circuit (2)
- 3.3.3 The voltage drop across each resistor (6)
- 3.3.4 The energy consumed by the circuit in three hours (4)
- [25]**

**QUESTION 4**

- 4.1 State THREE advantages and TWO disadvantages of secondary cells. (3 + 2) (5)
- 4.2 A single-phase transformer has 1 000 turns on the primary coil and 250 turns on the secondary coil. If the current in the secondary coil is 10 A determine the following quantities:
- 4.2.1 The current flowing through the primary windings (2)
- 4.2.2 The turns ratio (2)
- 4.2.3 The primary voltage if the secondary voltage is 55 V (2)
- 4.3 Define *relative density* (specific gravity) of the electrolyte of a cell. (3)
- [14]**

**QUESTION 5**

- 5.1 Name the FOUR major components of a measuring instrument. (4)
- 5.2 State TWO methods that can be used to extend the range of a moving coil instrument. (2)
- 5.3 Define *Faraday's first law of electromagnetic induction*. (4)
- [10]**

**QUESTION 6**

- 6.1 Define *semiconductor*. (4)
- 6.2 State THREE reasons for balancing loads (load distribution). (3)
- 6.3 Complete the following sentence by writing down the missing word next to the question number (6.3) in the ANSWER BOOK.  
A lightning arrester is installed to protect overhead lines against a rise in ... when lightning strikes. (1)
- [8]**

**QUESTION 7**

- 7.1 When must a certificate of compliance be obtained for an installation? (2)
- 7.2 Which instrument should be used to test the insulation resistance between conductors and what must the reading be? (2)
- 7.3 Three capacitors of 6  $\mu\text{F}$ , 8  $\mu\text{F}$  and 12  $\mu\text{F}$  are connected in parallel.  
Determine the total capacitance of this circuit. (2)
- 7.4 Write down the resistance value and tolerance for a resistor with yellow, violet, yellow and gold colour bands. (4)
- [10]**

**TOTAL: 100**

**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**

$$f = np$$

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