

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T380(E)(J28)T
AUGUST EXAMINATION
NATIONAL CERTIFICATE
ELECTRICAL TRADE THEORY N1

(11041861)

28 July 2016 (X-Paper)
09:00 – 12:00

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



ELECTTN1

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.
-

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 Good housekeeping means and increases in production and better working conditions.
- 1.2 The tool-rest of a grinding wheel must not be more than 3 mm from the wheel.
- 1.3 Energy is the amount of work done in a specific time.
- 1.4 The formula used to calculate electrical current is $V = I + R$.
- 1.5 Keepers are used on the poles of a magnet when stored for long periods of time.
- 1.6 Pulsating direct current can be increased or decreased with the aid of transformers.
- 1.7 The magnetic field around a conductor can be indicated with pieces of paper.
- 1.8 Secondary cells have a long lifespan.
- 1.9 The segments of a commutator are spaced with mica.
- 1.10 RMS value is 0.637 of the maximum value.
- 1.11 In a moving-coil instrument no coil is connected to the supply.
- 1.12 Flexible conduit may be used for the end connection of fixed appliances.
- 1.13 Flame-proof appliances must be used in spray-painting booths.
- 1.14 In the right-hand grip rule, the thumb will indicate the direction of the current flow.
- 1.15 Non-metallic conduit may not be threaded.
- 1.16 Glass is a good conductor of electricity.
- 1.17 Carbon and copper are used to manufacture motor brushes.
- 1.18 Socket outlets may not be installed within a 2 m radius of a water tap unless it has earth-leakage protection.
- 1.19 Geysers must be controlled by a switch disconnector or a socket outlet.
- 1.20 A zener diode is also known as a current-reference diode.

(20 x 1) **[20]**

QUESTION 2

- 2.1 Why is housekeeping important and desirable? (4)
- 2.2 State FIVE of the main causes of fire. (5)
- [9]**

QUESTION 3

- 3.1 In the equation $I = (V \div R)$ what electrical quantities do the three letters represent and what are the units used for each of these quantities? (6)
- 3.2 Two resistors of values 10Ω and 20Ω are connected in parallel across a 30 V supply.
Draw a neat, fully labelled schematic diagram of the circuit. (5)
- 3.3 Making use of the data given above, calculate the following electrical quantities:
- 3.3.1 The total resistance of the circuit (3)
- 3.3.2 The total current drawn from the supply (2)
- 3.3.3 The current flowing through each resistor (4)
- 3.3.4 The energy consumed by the circuit in two hours (4)
- [24]**

QUESTION 4

- 4.1 Explain how the direction of the flux in a conductor relative to the current can be determined by means of the right-hand rule. (6)
- 4.2 A single-phase transformer has a supply voltage of 220 V and a primary current of 10 A. The number of windings on the primary coil is 250 turns and on the secondary coil is 50 turns.
Calculate the following:
- 4.2.1 The turns-ratio (2)
- 4.2.2 The secondary voltage (3)
- 4.2.3 The secondary voltage current (3)
- [14]**

QUESTION 5

- 5.1 State FOUR conditions under which rigid non-metallic wireways shall be used. (4)
- 5.2 Draw the wiring symbol for each of the following:
 - 5.2.1 Fuse
 - 5.2.2 Battery
 - 5.2.3 Earth connection
 - 5.2.4 Bell
 - 5.2.5 Voltmeter
 - 5.2.6 Variable resistor (6 x 1) (6)
- 5.3 Define a circuit breaker, and state its purpose. (4)
[14]

QUESTION 6

- 6.1 Name TWO conductors generally used in practice. (2)
- 6.2 Name THREE properties of a good insulating material. (3)
- 6.3 Can carbon be used to wire domestic installations? (2)
- 6.4 What is the purpose of the bending spring? (2)
[9]

QUESTION 7

- 7.1 State TWO advantages of a moving-coil instrument. (2)
- 7.2 Name THREE tests that an accredited person must carry out on a new electrical installation before a certificate of compliance can be issued. (3)
- 7.3 Determine the value of a resistor with the following colour bands: Violet, Grey, Red and Gold. (5)
[10]

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

$$f = np$$

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



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MARKING GUIDELINE

**NATIONAL CERTIFICATE
AUGUST EXAMINATION
ELECTRICAL TRADE THEORY N1**

28 July 2016

This marking guideline consists of 6 pages.

QUESTION 1

- 1.1 True
- 1.2 True
- 1.3 **False**
- 1.4 False
- 1.5 True & False
- 1.6 True
- 1.7 False
- 1.8 **True**
- 1.9 True
- 1.10 False
- 1.11 False
- 1.12 True
- 1.13 True
- 1.14 True
- 1.15 True
- 1.16 False
- 1.17 True & False
- 1.18 True
- 1.19 True
- 1.20 False

(20 x 1) **[20]****QUESTION 2**

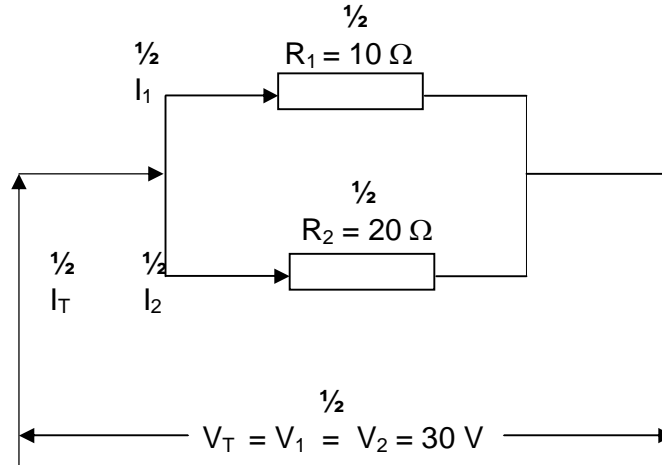
- 2.1
 - It cuts down on the time spent looking for goods, articles and tools
 - Space is saved
 - Injuries are avoided **(and any other reasonable answer)**
 - Fire hazards are reduced(4)

- 2.2
 - Electrical faults
 - Open flames
 - Friction
 - Chemical reactions **(and any other reasonable answer)**
 - Lightning
 - Matches
 - Cigarettes
 - Static electricity
 - Heated surfaces
 - Uncontrollable spontaneous ignition, et cetera.(Any 5 x 1) (5)
[9]

QUESTION 3

- 3.1 I Current flow measured in ampere (A)
 V Voltage drop/ potential difference measured in Volt (V)
 R Resistance measured in Ohm (Ω) (6)

3.2



(and any other reasonable circuit) (5)

(2 marks for sketch only)

3.3 3.3.1 $R_T = \frac{R_1 R_2}{R_1 + R_2}$
 $= \frac{10 \times 20}{10 + 20}$ (any other mathematically correct answer)
 $= 20 \div 3$
 $= 6,667$ (3)

3.3.2 $I_T = V_T \div R_T$
 $= 30 \div 6,667$
 $= 4,5 \text{ A}$ (2)

3.3.3 $I_1 = V_T \div R_1$ $I_2 = V_T \div R_2$
 $= 30 \div 10$ $= 30 \div 20$
 $= 3 \text{ A}$ $= 1,5 \text{ A}$ (4)

3.3.4 $Q_T = I_T R_T \times t$
 $= 4,52 \times 6,667 \times (2 \times 60 \times 60)$
 $= 972 \text{ 000 J}$
 $= 972 \text{ kJ}$ (4)
[24]

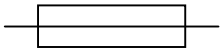

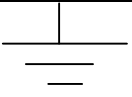

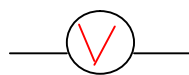
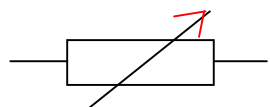
QUESTION 4

- 4.1 Hold the fingers of the right hand around the conductor. Point the thumb in the direction of the current flow. The direction of the flux will be indicated by the direction of the forefingers. (6)
- 4.2 4.2.1 Turns ratio = $(N_1 \div N_2)$
 $= 250 \div 50$
 $= 5:1$ (2)
- 4.2.2 $(V_1 \div V_2) = (N_1 \div N_2)$
 $V_2 = V_1 (N_2 \div N_1)$
 $= 220 (50 \div 250)$
 $= 44 \text{ V}$ (3)
- 4.2.3 $(N_1 \div N_2) = (I_2 \div I_1)$
 $I_2 = I_1 (N_1 \div N_2)$
 $= 10(250 \div 50)$
 $= 50 \text{ A}$ (3)
- [14]**

QUESTION 5

- 5.1
- Shall be clamped at least every 1m
 - May not be threaded **(and any other reasonable answer)**
 - Must be joined by means of couplers
 - Provide for expansion and contraction due to temperature
 - May not be used where they are likely to be damaged, unless protected
 - May not be used where their maximum temperature is likely to be exceeded (Any 4 x 1) (4)

5.2

	Item	Wiring Symbol
5.2.1	Fuse	
5.2.2	Battery	
5.2.3	Earth connection	
5.2.4	Bell	
5.2.5	Voltmeter	
5.2.6	Variable resistor	

(6)

5.3 A circuit breaker is a mechanical switching device that can operate as a manual switch. Its purpose is to automatically disconnect an appliance or circuit from the supply in the event of an abnormal condition such as an overcurrent.

(4)
[14]

QUESTION 6

6.1

- Copper **Gold** **Brass**
- Aluminium **Silver** **Carbon**

(2)

6.2

- High dielectric strength (allows no current flow)
- Durable
- Flexible **(and any other reasonable answer)**
- Mechanically strong
- Should not absorb moisture

(Any 3 x 1) (3)

6.3 No, Carbon is used in heavy current machines in the manufacture of resistors. (2)

6.4 To bend **PVC** conduit without the **conduit** walls collapsing (2)
Or to bend PVC Pipe [9]

QUESTION 7

- 7.1
- Fairly accurate
 - Almost uniform scale
 - Well shielded from stray magnetic fields
- (Any 2 x 1) (2)
- 7.2
- Insulation resistance test between conductors and earth
 - Insulation resistance test between conductors
 - Earth and bonding continuity test
 - Continuity test of conductors
 - Polarity test
 - Earth-leakage protection test
- (Any 3 x 1) (3)
- 7.3
- Violet 7
 - Grey 8
 - Red $\times 10^2$
 - Gold $\pm 5\%$ tolerance
- R = 7 800 \hat{o} $\pm 5\%$ tolerance
= 7,8 k \hat{o}
- (5)
[10]
- TOTAL 100**