higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NATIONAL CERTIFICATE (VOCATIONAL)

# ELECTRICAL PRINCIPLES AND PRACTICE
## NQF LEVEL 2

(12041002)

**19 February 2025 (Y-paper)**
**13:00–16:00**

**This question paper consists of 8 pages and a formula sheet.**

097Q1S2519

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# DEPARTMENT OF HIGHER EDUCATION AND TRAINING
# REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2
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. Use only a black or blue pen.
5. Round off all answers to THREE decimal places.
6. Write neatly and legibly.

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## QUESTION 1

1.1 Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–K) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

| COLUMN A | | COLUMN B | |
|---|---|---|---|
| 1.1.1 | The property of a phenomenon, body or substance where the property has a magnitude that can be expressed as a number and a reference | A | ampere |
| 1.1.2 | The rate of displacement of an object | B | mass |
| 1.1.3 | The length of time taken for 9 192 631 770 periods vibration of the caesium-133 atom to occur | C | acceleration |
| 1.1.4 | The amount of matter contained in an object measured in kilograms (kg) | D | second |
| 1.1.5 | The rate of change in velocity per unit time | E | force |
| 1.1.6 | An influence that changes the motion of a body or produces motion or stress in a free body | F | steradian |
| 1.1.7 | The force in Newtons with which the earth attracts an object | G | speed |
| 1.1.8 | The solid angle subtended at the centre of a sphere by an area of its surface equal to the square of the radius of the sphere | H | weight |
| 1.1.9 | The rate of change in position of an object | I | density |
| 1.1.10 | The mass per unit volume of an object | J | physical quantity |
| | | K | velocity |

(10 × 1) **[10]**

## QUESTION 2

2.1 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 (2.1.1–2.1.5) in the ANSWER BOOK.

2.1.1 Current that flows from the positive terminal to the negative terminal is called?

A electron current flow
B conventional current flow
C Electrical current flow
D Current flow

2.1.2 The greatest potential difference that can be produced by a force of electric current in a circuit is called … .

A voltage drop
B voltage supply
C potential difference
D electromotive force

2.1.3 The difference in electrical potential between two points in a circuit is called … .

A electron flow
B conventional flow
C potential difference
D electromotive force

2.1.4 The electrons orbiting in the outer shell are called … .

A electrons
B valence electrons
C conductors
D insulators

2.1.5 A material that blocks the flow of current.

A Resistor
B Valence electrons
C Conductor
D Insulator

(5 × 1) (5)

2.2 An electric kettle draws 7,5 A when connected to a 230 V supply.

Determine the resistance of the kettle. (3)

2.3 State TWO advantages of solid conductors. (2)

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2.4 State where the following types of materials are used.

2.4.1 Gold

2.4.2 Silver

2.4.3 Nichrome

2.4.4 Tungsten

(4 × 1) (4)

2.5 What will happen to the resistance of a conductor if:

2.5.1 Length of the conductor is increased

2.5.2 Cross-sectional area of the conductor is reduced.

(2 × 1) (2)

2.6 Temperature coefficient of resistance is the effect that the temperature has on the resistance of the material

2.6.1 Name TWO types of temperature coefficient. (2)

2.6.2 Describe the TWO types of temperature coefficient mentioned in QUESTION 2.6.1. (2)

2.7 Describe the difference between a *three-phase current* and *single-phase current*. (2)

2.8 Name THREE types of magnets. (3)

**[25]**

**QUESTION 3**

3.1 Choose the correct word or words from those given in brackets. Write only the word or words next to the question number (3.1.1–3.1.3) in the ANSWER BOOK.

| Internal resistance; close circuit; open circuit; short circuit; continuity |
|---|

3.1.1 A type of closed circuit in a larger circuit where there is a path of very low or zero resistance compared to normal circuit resistance.

3.1.2 A complete electric circuit in which current flows.

3.1.3 A state where the flow of current in an electric circuit is unbroken or uninterrupted.

(3 × 1) (3)

3.2 FIGURE 1 below represent the parallel grouping of THREE cells of 1,5 V each with the internal resistance of 0,2 Ω each.

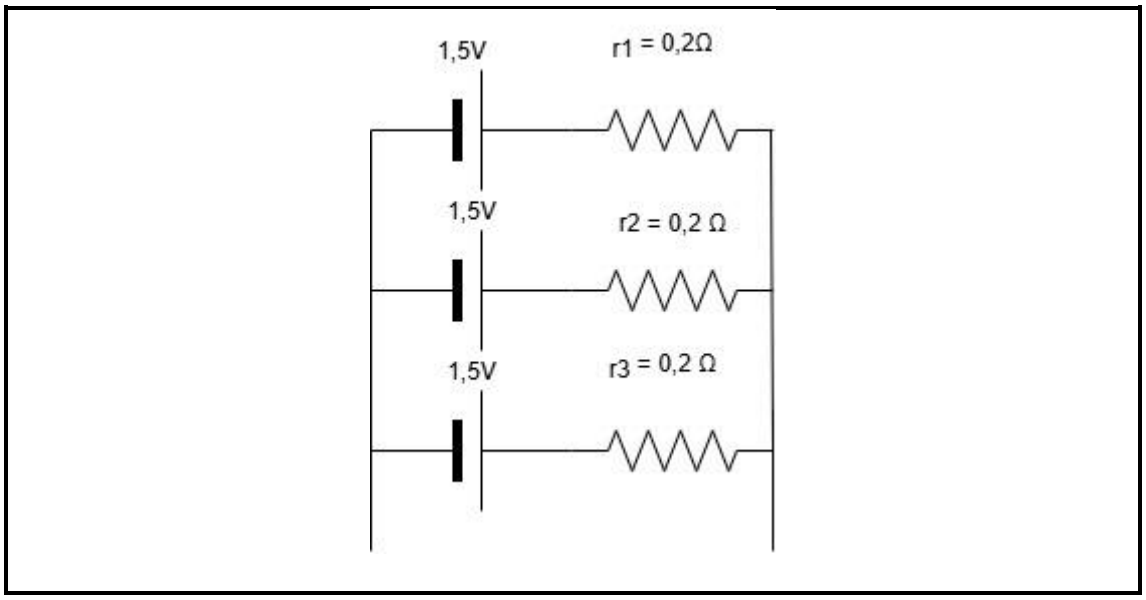



**FIGURE 1**

3.2.1 What is total EMF of the three cells? (1)

3.2.2 What is the total internal resistance of the three cells? (1)

3.3 Two resistors with values of 1000 Ω and 1800 Ω are connected in parallel. This combination is the connected in series with a 1200 Ω resistor across a 12 V supply.

3.3.1 Draw the circuit diagram of the above description. (4)

3.3.2 Calculate the resistance of the parallel resistor. (2)

3.3.3 Calculate the total resistance of the circuit. (2)

3.4 The following loads are supplied by a three phase four wire system of 230/400 V 50 Hz. All appliances are used simultaneously.

- 3 × 2 kW floodlight.
- 2 × 1,2 kW drilling machine
- 2 × sockets outlets each pulling 600 W

3.4.1 Show by means of calculation how would you balance these load listed above. (5)

3.4.2 Show, by means of a neat labelled sketch, how one would balance the calculated loads in QUESTION 3.4.1 (7)

**[25]**

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## QUESTION 4

4.1 Mention THREE measures to be taken to prevent electric shock by direct contact. (3)

4.2 Name THREE earthing identification codes used by countries all over the world. (3)

4.3 A 180 Ω resistor is connected in series with a 100 Ω resistor across a 12 V supply.

4.3.1 Draw a circuit diagram showing how to connect a voltmeter across the 100 Ω resistor and an ammeter to measure the total current flow in the circuit. (4)

4.3.2 Determine the reading of the ammeter. (2)

4.3.3 Determine the reading of the voltmeter. (2)

4.4 Give another name for an insulation tester. (1)

**[15]**

## QUESTION 5

5.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (5.1.1–5.1.5) in the ANSWER BOOK.

5.1.1 Wiring diagram uses electrical systems to represent all circuit components and shows how they are connected.

5.1.2 A ballast is a device for starting and regulating fluorescent and high-intensity discharge lamps.

5.1.3 A socket is a device with male contacts that are insulated with the fixed wiring and that receives a plug.

5.1.4 To isolate is to ensure that a circuit cannot become live while it is out of service for maintenance.

5.1.5 A stove uses a 6 $mm^2$ conductor.

(5 × 1) (5)

5.2 List at least THREE main components of an electrical circuit. (3)

5.3 Draw a neat, labelled circuit diagram of a geyser circuit including a thermostat. (7)

**[15]**

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## QUESTION 6

6.1 FIGURE 2 below is a picture of a steel wire armoured cable. Write down the name of the parts labelled A to E. Write only the answer next to the letter (A–E) in the ANSWER BOOK. (5)

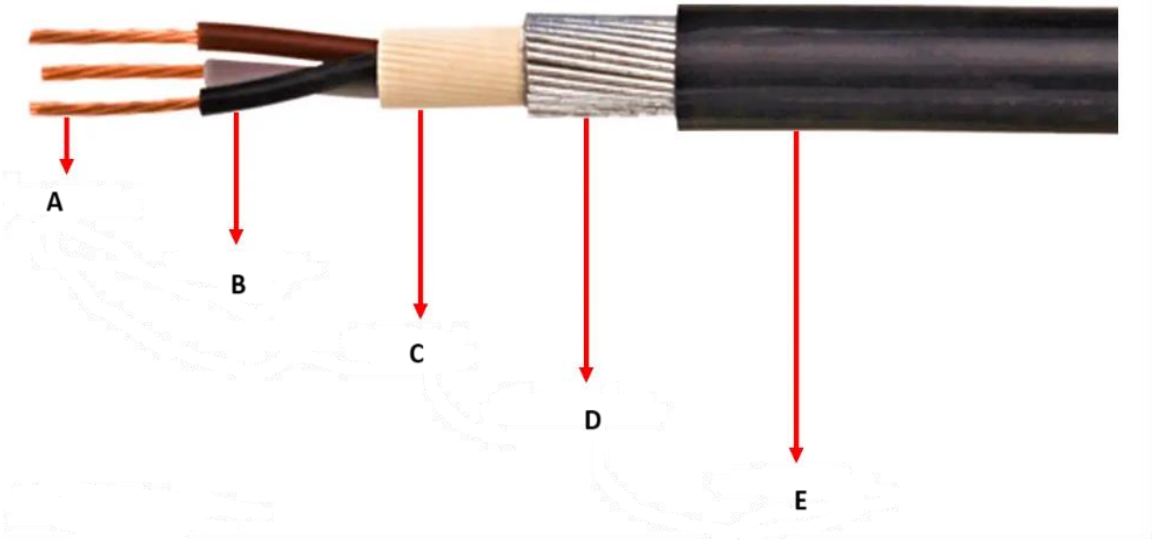



**FIGURE 2**

6.2 Describe the construction of a suspension-type insulator. (5)
**[10]**

**TOTAL: 100**

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(12041002)

## ELECTRICAL PRINCIPLES AND PRACTICE L2

## FORMULA SHEET

$v = \frac{d}{t}$ $\quad \bar{v} = \frac{d}{t}$ $\quad a = \frac{\Delta v}{\Delta t}$

$F = m \times a$ $\quad W = m \times g$ $\quad w = F \times s$

$\tau = F \times r$ $\quad \rho = \frac{m}{V}$ $\quad P = \frac{F}{A}$

$E = V + Ir$ $\quad V = IR$ $\quad P = VI$

$P = I^2R$ $\quad P = \frac{V^2}{R}$ $\quad E = P \times t$

$R = \frac{\rho l}{A}$ $\quad A = \pi r^2$ $\quad A = \frac{\pi D^2}{4}$

$R_t = R_0(1 + \alpha_0 T)$ $\quad t = \frac{1}{f}$ $\quad \beta = \frac{\phi}{A}$

$mmf = NI$ $\quad H = \frac{mmf}{\ell}$ $\quad H = \frac{NI}{\ell}$

$F = \beta I \ell$ $\quad \frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$ $\quad S = V_1 I_1 = V_2 I_2$

$R_T = R_1 + R_2 + R_3 \ldots\ldots,$ $\quad \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ $\quad R_T = \frac{R_1 \times R_2}{R_1 + R_2}$

$I_T = I_1 + I_2 + I_3 \ldots\ldots,$ $\quad I_T = I_1 = I_2 = I_3 \ldots\ldots,$ $\quad I_T = \frac{V_T}{R_T}$

$V_T = V_1 + V_2 + V_3 \ldots\ldots,$ $\quad V_T = V_1 = V_2 = V_3 \ldots\ldots,$ $\quad V_T = I_T \times R_T$

$V = E - Ir$ $\quad Q = I^2Rt$ $\quad I_{SH} = I - I_m$

$R_{SH} = \frac{I_M R_M}{I_M}$ $\quad R_{SH} = \frac{V}{I} - I_M$

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