



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

**ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2**

(12041002)

**10 November 2022 (Y-paper)
13:00–16:00**

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

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. Round off your answers to TWO decimal places.
 5. Start each section on a new page.
 6. Use only a black or blue pen.
 7. Write neatly and legibly.
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QUESTION 1

- 1.1 Convert 130 mm to m  (2)
- 1.2 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.2.1–1.2.5) in the ANSWER BOOK.
- 1.2.1 Power is measured in ohms.
- 1.2.2 The prefix 'm' stands for micro.
- 1.2.3 Velocity is the rate of change in position of an object.
- 1.2.4 Speed is measured in m.s^{-2}
- 1.2.5 To convert km to m, divide by 1000.  (5 × 1) (5)
- 1.3 A bus travels 10 km in 30 min. Calculate the average speed of the bus. (2)
- 1.4 Define *power*. (1)
- [10]**

QUESTION 2

- 2.1 Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–E) next to the question number (2.1.1–2.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B
2.1.1	The central part of an atom.	A Resistance
2.1.2	Electrons orbiting in the outermost shell 	B Potential difference
2.1.3	Materials that prevent the flow of current.	C Nucleus
2.1.4	The voltage measured across a battery on a closed circuit.	D Valence electrons
2.1.5	A measure of the ability of a substance or component to limit the flow of electric current.	E Insulator 

(5 × 1) (5)

- 2.2 A cell with an internal resistance of $0,78 \Omega$ is connected across a bulb. The current flowing through the bulb is 2 A and the emf of the cell is $1,8 \text{ V}$. Determine the potential difference of the circuit.  (3)
- 2.3 Define the following terms regarding magnetism.
- 2.3.1 Magnetic flux
- 2.3.2 Magnetic flux density (2 x 2) (4)
- 2.4 Complete the following sentences by writing only the missing word or words next to the question number (2.4.1–2.4.2) in the ANSWER BOOK.
- 2.4.1 When resistors are connected in series the voltage across each resistor is..... while the current is..... in the circuit.
- 2.4.2 When the resistors are connected in parallel the voltage across each resistor is..... while the current is.....in the circuit (4)
- 2.5 How is three-phase supply system generated?  (5)
- 2.6 With the aid of neat, labelled graphs, distinguish between AC and DC. (4)
- [25]**

QUESTION 3

- 3.1 What happens to the flow of current once a circuit is open-circuited? (1)
- 3.2 TWO cells each with an emf of $2,2 \text{ V}$ and internal resistance of $0,5 \Omega$ are connected in parallel across a 15Ω resistor. Determine the following quantities:
- 3.2.1 Draw a circuit diagram  (4)
- 3.2.2 The total resistance of the circuit (4)
- 3.2.3 The total current (2)
- 3.2.4 The volt drop across the resistor (2)
- 3.3 THREE resistors of 15Ω , 22Ω , 33Ω are connected in series across a 9 V battery.
- 3.3.1 The total resistance
- 3.3.2 The current flow  (4)
- 3.3.3 The voltage drop across 15Ω resistor (6)

- 3.4 State ONE advantages of load balancing in a three-phase system.  (1)
- 3.5 Briefly explain how a single-phase transformer operates on a no-load. (5)
- [25]**

QUESTION 4

- 4.1 Give THREE reasons why earthing is important. (3)
- 4.2 Name THREE devices of an analogue measuring instrument. (3)
- 4.3 Briefly explain the operation of an attraction type moving-iron instrument. (3)
- 4.4 Explain how you would connect the following measuring instruments in electrical circuits. 
- 4.4.1 Voltmeter
- 4.4.2 Ohmmeter
- 4.4.3 Ammeter
- 4.4.4 Frequency meter
- (4 × 1) (4)
- 4.5 State TWO precautions to be observed when using an insulation resistance tester.  (2)
- [15]**

QUESTION 5

- 5.1 Draw the electrical wiring symbols for the following:
- 5.1.1 Transformer
- 5.1.2 Motor
- 5.1.3 Lamp
- 5.1.4 Circuit breaker 
- 5.1.5 Fuse
- (5 × 1) (5)
- 5.2 Draw a circuit diagram to show how two luminaires are controlled by a single switch. (6)

5.3 State the circuit breaker sizes used to protect the following sub-circuits:

5.3.1 Stove



5.3.2 Lights

5.3.3 Socket outlets

5.3.4 Geyser

(4 × 1) (4)
[15]

QUESTION 6

6.1 Name THREE properties of steel



(3)

6.2 Explain the use of the following insulators

6.2.1 Pin-type insulator

6.2.2 Strain-type insulator

(2 × 1) (2)

6.3 Name FIVE electrical components that are found in an electrical distribution board.



(5)
[10]

TOTAL: 100

FORMULAE SHEET

ELECTRICAL PRINCIPLES AND PRACTICE L2

1. $E = V + Ir$

2. $R_t = R_0(1 + \alpha T)$

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

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

5. $V = I.R$

6. $I_T = \frac{V_T}{R_T}$

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

8. $R = \frac{\rho l}{A}$

9. $emf_T = emf_1 + emf_2 + emf_3$

10. $emf_T = emf_1 = emf_2 = emf_3 = \dots$

11. $r_T = r_1 + r_2 + r_3$

12. $\frac{1}{r_T} = \frac{1}{r_1} = \frac{1}{r_2} + \frac{1}{r_3}$

13. $I_T = \frac{emf_T}{R_T + r_T}$

14. $v = d/t$

15. $\bar{v} = \Delta s / \Delta t$

16. $v = \Delta s / \Delta t$

17. $F = m \times a$

18. $W = m \times g$

19. $w = F \times s$

20. $\tau = F \times r$

21. $\rho = \frac{m}{V}$

22. $P = E/t$

23. $B = \frac{\Phi}{A}$

24. $H = \frac{mmf}{l}$

25. $V_T = I_T R_{se} + I_T R_m$