higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2

(12041002)

15 March 2021 (Y-paper)
13:00–16:00

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

095Q1S2115000466

02028027

095Q1S2115

Please turn over

08928027–095Q1S211520-0108

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. Use only a black or blue pen.
5. Round off the answers to two decimal places.
6. Write neatly and legibly.

08928027--095Q1S211520-0208

QUESTION 1

1.1 Name FOUR basic units of measurement used in engineering. (4)

1.2 Convert 1 kW h into Megajoules (MJ) (3)

1.3 Determine the force required to accelerate a body with a mass of 300 g at $5\ m/s^2$. (3)
[10]

QUESTION 2

2.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1.1–2.1.3) in the ANSWER BOOK.

2.1.1 Atoms are tiny particles from which elements are made.

2.1.2 The current that flows from the positive terminal of a battery to the negative terminal is known as electron current flow.

2.1.3 Power is the ability to do work.

(3 × 1) (3)

2.2 Explain the term *electromotive force*. (1)

2.3 With reference to atoms, explain what is meant by positive charge. (2)

2.4 An electrical heater uses $30KJ$ of energy in 15 seconds when connected to a 230 V supply.

Calculate the following:

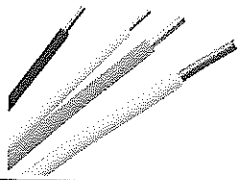
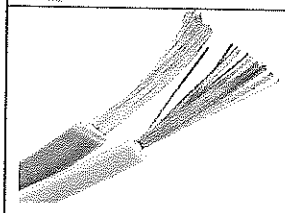
2.4.1 The power rating of the heater

2.4.2 The current drawn from the supply

(2 × 2) (4)

2.5 Conductors used in the electrical industry come in different physical shapes and sizes.

Identify the following conductors and state their application:

Conductor	Name of Conductor	Application
	2.5.1	2.5.2
	2.5.3	2.5.4

(4)

2.6 Calculate the resistance of a copper conductor with a length of 4 km and a radius of 6 mm. Take the resistivity of copper as 0,0173 μΩm. (4)

2.7 Explain the difference between *alternating current (AC)* and *direct current (DC).* (2)

2.8 State TWO advantages of a single-phase supply system. (2)

2.9 State the Fleming's left-hand rule as used to determine the direction of the magnetic field around a current carrying conductor. (3)

[25]

QUESTION 3

3.1 Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–E) next to the question number (3.1.1–3.1.4) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	Will ensure that the current divides	A	cells in series
3.1.2	When the positive terminal of one cell is connected to the negative terminal of another cell	B	cells in parallel
		C	series-parallel circuit
3.1.3	Will ensure that the potential difference will divide	D	series circuit
		E	parallel circuit
3.1.4	Will ensure that the total EMF will be the same as the EMF of one cell		

(4 × 1) (4)

3.2 TWO cells each with an EMF of 3 V and an internal resistance of 0,2 Ω are connected in parallel across a 33 Ω resistor.

Calculate the following quantities:

3.2.1 The current flowing in the circuit (4)

3.2.2 The voltage drop across the 33 Ω resistor (2)

3.3 Answer the questions with regard to FIGURE 1:

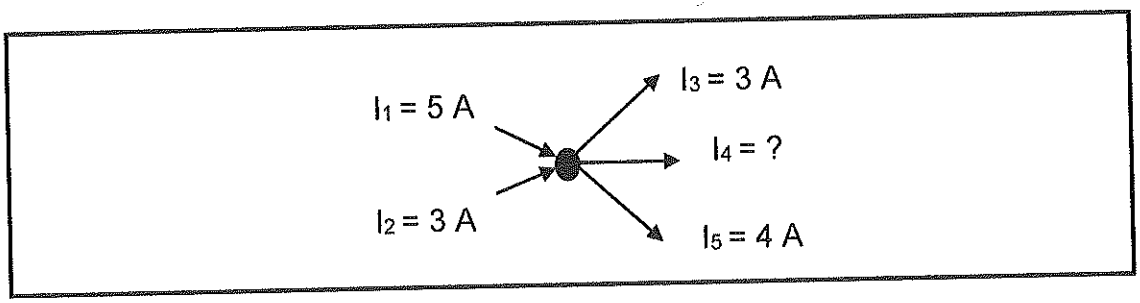


FIGURE 1

3.3.1 Name the law that you would use to calculate the unknown current (I_4) in FIGURE 1. (1)

3.3.2 State the law in sub-question 3.3 1. (1)

3.3.3 Calculate the value of the unknown current (I_4). (3)

3.4 Calculate the load per phase using the information below. The supply is a three-phase, four-wire system 230 / 400 V, 50 Hz.

- 3 x 1 kW, 230V halogen floodlights
- 3 x 1,5 kW, 230V electric motor

(6)

3.5 Name any ONE of the two methods used to cool transformers. (1)

3.6 A transformer has a supply voltage of 230 V and a primary current of 8 A. There are 100 turns on the primary side and 25 turns on the secondary side.

Calculate the secondary voltage. (3)

[25]

QUESTION 4

4.1 Give FOUR reasons why it is important to earth electrical installations and appliances. (4)

4.2 Explain what is meant by the term *parallax error* as applicable to analogue meters. (2)

4.3 Briefly explain the operation of a moving iron, repulsion type instrument. (3)

4.4 State THREE safety precautions that should be taken into consideration when using a clamp meter. (3)

4.5 Briefly explain how the range of the following meters can be increased:

4.5.1 Voltmeter (2)

4.5.2 Ammeter (1)

[15]

QUESTION 5

5.1 Compile a parts list of the components inside an electrical installations distribution board.

The distribution board has to supply the following sub-circuits:

- Bell circuit
- Light circuit
- Socket outlets
- Geyser circuit
- Stove circuit

(8)

NOTE: Your parts list must include EIGHT measured parts (conductor sizes and circuit-breaker ratings).

5.2 Draw a neat and fully labelled diagram of a geyser circuit.

Your sketch must include an isolator and a ripple relay. (7)

[15]

QUESTION 6

6.1 Draw a neat, fully labelled circuit diagram of a simmerstat switch. (6)

6.2 Describe the following types of cells and give ONE example of each type.

Type of a Cell	Cell description	Example
Primary cells	6.2.1	6.2.2
Secondary cells	6.2.3	6.2.4

(4)

[10]

TOTAL: 100

FORMULA SHEET

1. $v = \frac{d}{t}$
2. $\bar{v} = \frac{d}{t}$
3. $a = \frac{\Delta v}{\Delta t}$
4. $F = m \times a$
5. $W = m \times \mathrm{g}$
6. $w = F \times s$
7. $\tau = F \times r$
8. $\rho = \frac{m}{v}$
9. $P = \frac{F}{A}$
10. $E = V + Ir$
11. $V = IR$
12. $P = VI$
13. $P = I^2R$
14. $P = \frac{V^2}{R}$
15. $E = P \times t$
16. $R = \frac{\rho \ell}{A}$
17. $A = \pi r^2$
18. $A = \frac{\pi D^2}{4}$
19. $R_T = R_0(1 + \alpha_0 T)$
20. $t = \frac{1}{f}$
21. $\beta = \frac{\phi}{A}$
22. $mmf = NI$
23. $H = \frac{mmf}{\ell}$
24. $H = \frac{NI}{\ell}$
25. $F = \beta I \ell$
26. $\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$
27. $S = V_1 I_1 = V_2 I_2$
28. $R_T = R_1 + R_2 + R_3 + \cdots$
29. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$
30. $R_T = \frac{R_1 \times R_2}{R_1 + R_2}$
31. $I_T = I_1 = I_2 = I_3 = \cdots$
32. $I_T = I_1 + I_2 + I_3 + \cdots$
33. $I_T = \frac{V_T}{R_T}$
34. $V_T = V_1 = V_2 = V_3 = \cdots$
35. $V_T = V_1 + V_2 = V_3 + \cdots$
36. $V_T = I_T \times R_T$
37. $V = E - Ir$
38. $Q = I^2Rt$
39. $R_{sh}\ \frac{I_m \times R_m}{I - I_m}$
40. $I_{sh} = I - I_m$
41. $R_{se} = \frac{V}{I} - R_m$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