higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2

(12041002)

15 November 2024 (Y-paper)
13:00–16:00

This question paper consists of 8 pages and 1 formula sheet.

201Q1N2415

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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

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

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 Absolute zero is the temperature at which all thermal motion ceases.

1.2 A mole is the amount of a substance that contains as few atoms as in 0,012 kg of isotope carbon-12.

1.3 Exponent is a number that shows how many times another number should be divided by itself.

1.4 Velocity is measured in Newton.

1.5 The SI unit of electrical resistance is a Joule.

1.6 Power is the rate of energy transfer.

1.7 The unit of power that equals one Joule of work or energy per second is called a Watt.

1.8 Work and energy transferred must, therefore, be measured in the same unit, namely the ohms.

1.9 A prefix is part of a unit symbol.

1.10 A kilogram is the mass of the international prototype kilogram.

(10 × 1) **[10]**

QUESTION 2

2.1 Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–K) next to the question number (2.1.1–2.1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1.1	The average mass number of an atom in a sample of an element	A	electron current flow
2.1.2	The mass of the nucleus of an atom	B	proportional
2.1.3	Electrons in the outermost shell of an atom	C	circuit
2.1.4	The flow of electrons	D	potential difference
2.1.5	This is calculated using formula $V = IR$	E	electric current
2.1.6	The path along which an electric current flows	F	valence electrons
2.1.7	Current flows from negative to positive	G	relative atomic mass
2.1.8	Describe the relationship between things in terms of their size or quantity	H	atomic number
2.1.9	Elements are made of tiny particles called?	I	proton
2.1.10	Positively charged particle in the nucleus of an atom	J	electron flow
		K	atoms

(10 × 1) (10)

2.2 Study the circuit diagram in FIGURE 1 and explain the function of each of the components indicated below:

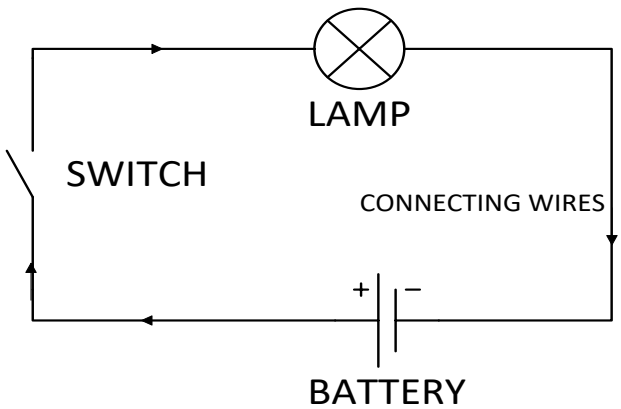


FIGURE 1

2.2.1 Battery

2.2.2 Switch

2.2.3 Lamp

2.2.4 Connecting wires

(4 × 1) (4)

2.3 The resistance of a copper cable at 0ºC is 60 Ω. Calculate the resistance at a temperature of 25 ºC. Take the temperature coefficient of resistance of copper at 0ºC as 0,004 /ºC. (3)

2.4 Explain how electricity is supplied from power stations to the consumers and businesses in South Africa. (6)

2.5 Explain the law of magnetism. (2)

[25]

QUESTION 3

3.1 THREE identical cells with an EMF of 1,2 V each and an internal resistance of 0,6 Ω are connected in parallel across a 24 Ω resistor.

Calculate:

3.1.1 The total internal resistance

3.1.2 The total EMF

3.1.3 The current through the external resistor

3.1.4 The current supplied by each cell

3.1.5 The potential difference across the 24 Ω resistor

(2 × 5) (10)

3.2 Explain what will happen to the voltage, current and resistance when resistors are connected in series. (3)

3.3 Your are give THREE resistors R_1 = 270 Ω, R_2 = 390 Ω and R_3 = 470 Ω to connected in series- parallel across a 12 V battery.

3.3.1 Draw the circuit diagram when R_1 and R_2 are connected in parallel and the combination is connected in series with R_3. The circuit is supplied by the 12 V battery. (4)

3.3.2 Calculate the total resistance of the circuit. (5)

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

3.4 Give ONE advantage of load balancing. (1)

[25]

QUESTION 4

4.1 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 (4.1.1–4.1.5) in the ANSWER BOOK.

4.1.1 What is a fault current that flows to earth?

A Earth spike
B Earth leakage current
C Earth fault current
D Short-circuit current

4.1.2 A current that results from an insulation failure or from bridging of insulation is called?

A Fault current
B Resistance
C Overcurrent
D Shock current

4.1.3 A conductor, including any clamp, or terminal, that connects the consumer's earth terminal to the exposed conductive parts of an insulation for the purpose of earthing such parts and carrying fault currents is called?

A Live conductor
B Neutral conductor
C Star point
D Earth continuity conductor

4.1.4 What is a conductor, including any clamp or terminal, by which the connection of a consumer's earth terminal or conductor to an earth electrode, or to the supplier's protective conductor, called?

A Earthing conductor
B Protective conductor
C Functional earthing conductor
D Functional bonding conductor

4.1.5 A terminal fitted to equipment or power devices or intended for electric connection with the earthing arrangement.

A Protective conductor
B Earthing terminal
C Earth fault current
D Earth bonding continuity conductor

(5 × 1) (5)

4.2 What is the purpose of bonding? (3)

4.3 Multi-meters are basically categorised as analogue and digital multi-meters.

State the difference between *analogue* and *digital multi-meters.* (2)

4.4 Give another name for a Wattmeter. (1)

4.5 Explain TWO precautions to be taken when using a clamp meter. (2)

4.6 Name TWO types of instrument transformers. (2)
[15]

QUESTION 5

5.1 What is the function of the following electrical components?

5.1.1 Circuit breaker

5.1.2 Fuse

(2 × 1) (2)

5.2 Draw a neat labelled sub-circuit diagram of one luminaire controlled from one switch and one circuit breaker. (5)

5.3 Draw the IEC symbol of the following components:

5.3.1 Single-pole switch

5.3.2 Fuse

5.3.3 Bulb

5.3.4 AC motor

5.3.5 Bell

5.3.6 Battery

5.3.7 Circuit breaker

(7 × 1) (7)

5.4 Explain the function of intermediate switching. (1)
[15]

QUESTION 6

6.1 Primary cells are cells that can only be used once. Once its chemicals are used up they need to be replaced.

Name any THREE examples of primary cells. (3)

6.2 Differentiate between an *incandescent lamp* and *compact fluorescent lamp*. (2)

6.3 Annealed copper, hard drawn coper and aluminium are good conductors of electricity.

Name FIVE material properties of aluminium. (5)
[10]

TOTAL: 100

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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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