higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL SYSTEMS AND CONSTRUCTION
NQF LEVEL 3

(12041033)

16 November 2022 (X-paper)
09:00–12:00

This question paper consists of 8 pages.

383Q1N2216

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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. Start each question on a new page.
5. Use only a black or a blue pen.
6. Write neatly and legibly.

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QUESTION 1

1.1 In South Africa, electrical installations must comply with the Code of Practice for the Wiring of Premises, SANS 10142-1.

State the aim of SANS 10142-1. (2)

1.2 Complete the following paragraph by filling in the missing word or words. Write only the missing word or words next to the question number (1.2.1–1.2.5) in the ANSWER BOOK.

Each installation shall have a (1.2.1 …). Conductive parts that are to be (1.2.2 …) shall be connected to an (1.2.3 …) which is connected to the consumer's earth terminal. The consumer's earth terminal shall be earthed by connecting it to the (1.2.4 …) or protective conductor and, if installed, the (1.2.5 …). The effectiveness of the supplier's protective conductor shall be determined in accordance with 8.7.5. (5)

1.3 Define the term, *luminaire.* (3)

1.4 State the circuit breaker rating for each of the following sub-circuits in a domestic installation:

1.4.1 Lights

1.4.2 Socket outlets

1.4.3 Stove

(3 × 1) (3)

1.5 FIGURE 1 shows the parts of a compression gland. Name the parts labelled A to E. Write only the answer next to the letter (A–E) in the ANSWER BOOK.

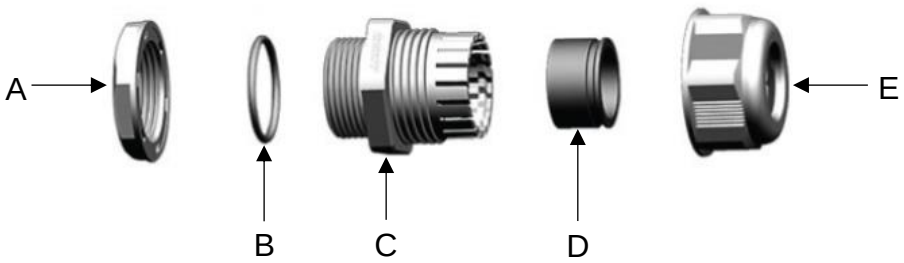

FIGURE 1

(5 × 1) (5)

1.6 A conduit is a pipe, usually of diameter not exceeding 50 mm, that allows conductors and cables in installations to be drawn in and to be replaced.

State THREE advantages of PVC conduit. (3)

1.7 Give TWO guidelines to consider when selecting an electrical cable. (2)

1.8 Explain what an armoured cable is. (2)

[25]

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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 (2.1.1–2.1.10) in the ANSWER BOOK.

2.1.1 The difference in voltage between the point of supply and any point of outlet shall not exceed … of the standard voltage or of the declared phase-to-neutral voltage.

A 1%
B 5%
C 10%
D 15%

2.1.2 The test button on an earth leakage unit is used to check ...

A the sensitivity of the earth leakage unit.
B continuity.
C that the trip mechanism operates correctly.
D polarity.

2.1.3 When carrying out an insulation resistance test at the distribution board, ensure that the test voltage is at least … the supply voltage.

A half
B the same as
C four times
D twice

2.1.4 A/an … test is done to ensure that the consumer's earth terminal and all earthing points in the installation are connected together.

A insulation resistance
B earth resistance
C resistance of earth continuity conductor
D earth loop impedance

2.1.5 The supply must be switched on when conducting a/an …

A insulation resistance test.
B operation of earth leakage unit test.
C continuity of bonding test.
D earth continuity test.

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2.1.6 When conducting an insulation resistance test between conductors and earth at the distribution board, an acceptable reading will be:

A 10 kΩ
B 0, 1 MΩ
C 1 000 Ω
D 1 000 000 Ω

2.1.7 Disconnect the installation and inform the supplier if the voltage between the supply neutral and any earth external to the installation exceeds …

A 50 V.
B 10V.
C 25 V.
D 15V.

2.1.8 A multi meter set on the lowest ohm scale can be used to conduct the following test:

A Resistance of the earth continuity conductor
B Earth loop impedance
C Earth resistance
D Insulation resistance

2.1.9 Conductive roofs, gutters, down pipes and waste pipes shall be bonded and earthed and the resistance of the earth continuity path shall not exceed …

A 0, 01 Ω.
B 0, 2 Ω.
C 0, 5 Ω.
D 0, 9 Ω.

2.1.10 A polarity test is done to ensure that the … conductor is connected to all circuit breakers and switches.

A phase
B neutral
C earth
D PEN

(10 × 1) (10)

2.2 Once the wiring is complete, the electrical installation must be inspected in accordance with section 4 of the test report.

Name FOUR items that must be permanently marked or labelled in an electrical installation. (4)

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2.3 A registered person must identify the type of earthing system used when issuing a certificate of compliance.

Explain what is meant by a TN-C-S earthing system. (3)

2.4 Name TWO components mounted in a meter box of a single-phase domestic electrical installation. (2)

2.5 Illustrate by means of a neat, labelled sketch, how a continuity of bonding test can be carried out in a single-phase dwelling. (6)

[25]

QUESTION 3

3.1 Safe operating procedures are written guidelines for procedures and tasks involving recognised hazards.

State THREE types of tasks that require the writing of safe operating procedures. (3)

3.2 As an electrician, you are required to test an isolator to ensure that it is in good working condition.

3.2.1 Name the instrument that you will use to perform a continuity test on an isolator. (1)

3.2.2 On what scale would you set the instrument referred to in QUESTION 3.2.1? (1)

3.2.3 While performing the continuity test on an isolator in the off position, a 0 Ω reading is obtained. Is this reading acceptable? Substantiate your answer. (2)

3.3 Maintenance is a process of keeping electrical equipment in proper working condition.

List THREE types of maintenance procedures that are performed by artisans in an engineering plant. (3)

3.4 A single-phase capacitor-start, capacitor-run induction motor is reported to be faulty.

Name FOUR tests that can be carried out on the motor to identify the cause of the problem. (4)

3.5 Explain the purpose of an interlock switch. (1)

[15]

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QUESTION 4

4.1 Give ONE advantage for each of the following power distribution systems:

4.1.1 Radial distribution system

4.1.2 Ring distribution system

(2 × 1) (2)

4.2 Secondary distribution comprises the low-voltage network laid along the streets or over the fields and from which service connections are tapped off to individual customers.

Name TWO types of LV networks. (2)

4.3 Give ONE application in which a lock-out is used. (1)

4.4 State TWO factors that must be taken into consideration when planning electrical work on a low-voltage network (2)

4.5 Earthing is the connection of all accessible conductive parts, including parts that do not form part of an electrical circuit but may accidentally become live, to the source earth in such a way that they are earthed.

State THREE main functions of earthing. (3)

[10]

QUESTION 5

5.1 Incandescent lamps were widely used due to their low initial cost, easy installation and simple operation.

Explain the operating principle of incandescent lamps. (3)

5.2 What is the average life of an incandescent lamp? (1)

5.3 Fluorescent lamps are low pressure mercury electric discharge lamps, tubular in shape, in which a fluorescent coating (phosphor) transforms ultraviolet energy into visible light.

Draw a neat, fully labelled circuit diagram for the connection of a single fluorescent lamp. (5)

5.4 Give TWO applications where fluorescent lamps are used. (2)

5.5 A preventative maintenance plan should be developed and implemented to keep the lighting system in proper working condition.

List FOUR tasks that should be carried out on a lighting system during maintenance. (4)

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QUESTION 6

6.1 Installing solar panels is a high-risk activity and workers must be protected against falls that may result from working on roofs.

Explain what is meant by a *fall restraint system*. (3)

6.2 Name the physical process in which a solar cell converts sunlight into electricity. (1)

6.3 What is the purpose of a by-pass diode in a photovoltaic module? (2)

6.4 Give FOUR benefits of installing a solar water heater. (4)

[10]

TOTAL: 100

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