



**higher education  
& training**

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL CERTIFICATE (VOCATIONAL)**

**ELECTRICAL SYSTEMS AND CONSTRUCTION  
NQF LEVEL 3**

(12041033)

**7 December 2020 (Y-paper)  
13:00–16:00**

**This question paper consists of 7 pages.**

**341Q1N2007**

<p><b>TIME: 3 HOURS</b> <b>MARKS: 100</b></p>
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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. Start each question on a new page.
  5. Use only a black or blue pen.
  6. Write neatly and legibly.
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**QUESTION 1**

1.1 Define the term *electrical contractor*. (2)

1.2 It shall not be possible to touch any live part within arm's reach with the standard test finger.



State the limitations of arm's reach. (4)

1.3 The aim of bonding is to bring all the bonded parts to the same electrical potential.

State the requirement pertaining to the bonding of antennas in a residential installation. (2)

1.4 Give FOUR guidelines to follow when drawing circuit diagrams. (4)

1.5 The table below consists of electrical appliances and components:



Complete the table below by writing ONLY the answer next to the question number (1.5.1–1.5.5) in the ANSWER BOOK.

Electrical Circuit	Conductor Size	Circuit Breaker Rating
Stove	1.5.1 ...	35 A
Geyser	4 mm <sup>2</sup>	1.5.2 ...
Socket outlet	1.5.3 ...	20 A
Lighting	1,5 mm <sup>2</sup>	1.5.4 ...
Bell	1.5.5 ...	1 A

(5 × 1) (5)

1.6 Name FOUR accessories available for metal conduit in the electrical industry. (4)

1.7 State the function of a steel draw tape.



(2)

1.8 One of the variables to consider when selecting a cable is the 'permissible voltage drop'.

With reference to SANS 10142-1, explain the term *permissible voltage drop*. (2)

**[25]**

**QUESTION 2**

2.1 What is the reason for conducting earth resistance test at the electrodes? (1)

2.2 State TWO conditions on which the earth resistance test should be conducted. (2)

2.3 The aim of bonding is to bring all the bonded parts to the same electrical potential.



Illustrate by means of a fully labelled sketch, how the *continuity of bonding test* is performed. (6)

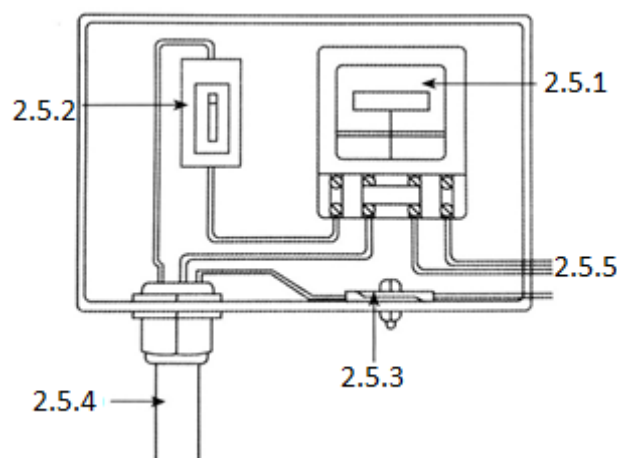
2.4 At the main switch, the impedance must be such that an earth fault current will double (or more than double) the rated current of the main protective device and automatically disconnect the supply to the installation.

Explain what should be done if the requirement above cannot be achieved. (4)

2.5 FIGURE 1 shows a diagram for a meter box layout for a single phase domestic installation.



Identify the parts of the meter box layout, labelled (2.5.1–2.5.5), in FIGURE 1.



**FIGURE 1** (5)


2.6 You have been tasked by your supervisor to test the sensitivity of an earth leakage relay.



2.6.1 Name the instrument required for the test. (1)

2.6.2 Explain the procedure to be followed when conducting this test. (3)

2.6.3 What should be the acceptable results? (1)

- 2.7 In the case of an older electrical installation that came into existence before the Wiring Code came into force, a certificate of compliance will be issued if the installation is found to be reasonably safe. 

What does the Wiring Code stipulate, if an addition or alteration has been made to an electrical installation for which a certificate was previously issued?

(2)  
[25]

### QUESTION 3

- 3.1 Safety is the state of being free from risk or danger.

With reference to safety, state TWO responsibilities of an employer towards employees in the workplace.


(2)

- 3.2 When doing fault finding it is important to identify all sources of supply as well as hazards likely to be encountered.

Give FOUR hazards that may be encountered during the fault-finding process.

(4)

- 3.3 When planning for fault finding, you need to consider the following:

- When must the task start? 
- How many workers will be available?
- When must the task be completed?

Give FOUR other factors that must be considered when planning for fault finding.

(4)

- 3.4 A geyser is reported to be faulty.

State THREE possible faults that can occur in a geyser circuit.



(3)

- 3.5 State TWO common tests that are performed on electrical cables. 

(2)  
[15]

**QUESTION 4**

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (4.1.1–4.1.10) in the ANSWER BOOK.

- 4.1 Low voltage refers to nominal voltage levels up to and including 11 kV. 
- 4.2 Ring distribution systems are less reliable than radial distribution systems.
- 4.3 Capacitors are the most common method for correcting low-power factor.
- 4.4 It is important to notify affected customers of the outage times should the network be switched off.
- 4.5 Cables used for earthing should be as short as possible.
- 4.6 Bare aluminium is most suitable for use as an earth electrode.
- 4.7 Class one appliances need not be earthed.
- 4.8 Insulating mats are used when work is done on 'live' circuits.
- 4.9 Lockouts may be used when bypassing guards or safety devices.
- 4.10 Up to the point of supply, only the TN-S earthing system is permitted for use in South Africa. 

(10 × 1)


**[10]****QUESTION 5**

- 5.1 You are given a job card to install a high-pressure mercury vapour lamp outside the electrical workshop.

Draw a neat, fully labelled circuit diagram for the connection of a high-pressure mercury vapour lamp to assist you with the installation. (6)

- 5.2 Maintenance must be done on lighting systems to ensure that they function optimally.

Briefly describe the procedure to follow when checking the connections at lighting points. (3)

- 5.3 One of the results of a low power factor is that the consumer will pay more for electricity. 

State TWO other disadvantages of a low power factor. (2)

- 5.4 What does SANS 10142-1 stipulate with regard to surface mounted luminaires? (2)

5.5 Give TWO functions of a starter in a fluorescent lamp fitting.

(2)  
[15]

**QUESTION 6**

6.1 Choose a word/s from COLUMN B that match(es) a description in COLUMN A. Write only the letter (A–F) next to the question number (6.1.1–6.1.5) in the ANSWER BOOK.



COLUMN A		COLUMN B	
6.1.1	Used to avoid the high resistance of the shaded PV panel	A	photovoltaic cell
6.1.2	When photovoltaic modules are connected	B	anti-reflective layer
6.1.3	Found between the PV grid lines to increase the amount of light transmitted to the semiconductor material	C	$V_{oc}$
		D	bypass diode
		E	arrays
		F	blocking diode
6.1.4	Also known as a solar cell		
6.1.5	The maximum voltage when no current is drawn from the circuit on a PV panel		



(5 × 1) (5)

6.2 State the function of a photovoltaic inverter.

(2)

6.3 Solar thermal collectors absorb and retain heat from the sun and use it to heat up water.



Give THREE sources of heat loss in a solar thermal collector.

(3)  
[10]

**TOTAL: 100**