higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

SPECIALISED ELECTRICAL INSTALLATION CODES

(First Paper)

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
SPECIALISED ELECTRICAL INSTALLATION CODES
(First Paper)
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 section on a new page.
5. Use only a blue or black pen.
6. Write neatly and legibly.

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QUESTION 1: OCCUPATIONAL HEALTH AND SAFETY ACT, ACT 85 OF 1993 – ELECTRICAL INSTALLATION REGULATIONS

1.1 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 (1.1.1–1.1.3) in the ANSWER BOOK.

1.1.1 Installation work means the …

A installation, extension, modification or repair of an electrical installation.
B scheduled maintenance of an electrical installation.
C scheduled servicing of electrical machinery.
D issuing of a certificate of compliance after an electrical fault.

1.1.2 Specialised electrical installations means electrical installations in …

A explosive atmospheres as contemplated in SANS11042-1.
B the petroleum industry as contemplated in SANS 1 1089-3.
C hazardous locations as contemplated in SANS 11109.
D medical locations as contemplated in SANS 10142-1.

1.1.3 Which ONE of the following is true with regard to the Certificate of Compliance?

A Subject to the provisions of Subregulation 3, every user or lessor of an electrical installation, as the case may be, shall have a valid certificate of compliance for that installation in the form of Annexure 1.
B If an inspector, an approved inspection authority for electrical installations or owner has carried out an inspection or test and has detected any fault or defect in any electrical installation, that inspector, approved inspection authority for electrical installations or owner may isolate that installation and declare the certificate of compliance invalid.
C The relevant supplier may at a reasonable fee, inspect and repair any electrical installation, provided that the supplier shall charge a reasonable fee for the issuing of a certificate of compliance.
D Subregulation 3 shall not apply to an electrical installation that existed prior to 1 April 1994 and where there was a change of ownership after 23 October 1999.

(3 × 1) (3)

1.2 Every employer shall provide and maintain, as far as is reasonably practicable, a work environment that is safe and without risk to the health of the employees.

State EIGHT matters referred to by a work environment that is safe and without risk to the health of the employees. (8)

1.3 What role does the approved inspection authority play according to the OHS Act regarding electrical installations? (3)

1.4 The construction regulations in the above-mentioned act contain certain requirements which specifically deal with electrical installations and more specifically temporary installations on construction sites.

State FOUR of these requirements. (4)
[18]

QUESTION 2: SANS 10142-1: MEDICAL SUPPLY SYSTEMS

2.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–C) next to the question number (2.1.1–2.1.5) in the ANSWER BOOK.

2.1.1 Medical electrical equipment: Electrical equipment provided with not more than one connection to a particular supply mains and intended to diagnose, treat or monitor a patient under medical supervision and to …

A break physical or electrical contact with the patient.
B transfer energy to or from the supply mains.
C detect energy transfer to or from the patient.

2.1.2 Medical electrical system: Combination of more than one item of medical electrical equipment and other nonmedical equipment that have a specified function and are interconnected by …

A busbars.
B a multiple portable socket outlet.
C isolators.

2.1.3 When using SELV or PELV circuits (or both) in groups 1 and 2 medical locations, the nominal voltage applied to current-using equipment shall not exceed …

A 50 V RMS AC or 120 V ripple-free DC.
B 25 V RMS AC or 60 V ripple-free DC.
C 110 V RMS AC or 250 V ripple-free DC.

2.1.4 In the case of each group 2 medical location, at least one separate medical IT system is necessary. The medical IT system shall be equipped with an insulation-monitoring device that …

A has an internal impedance of at least 100 kΩ.
B has a test voltage not exceeding 250 V DC.
C is of a current, even under fault conditions, not exceeding 10 mA DC.

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2.1.5 In group 2 medical locations, protection by automatic disconnection of the supply by means of earth-leakage protection devices that have a rated earth-leakage tripping current (rated residual current) not exceeding 30 mA shall only be used on the circuits for …

A X-ray units.
B small equipment with a rated power not exceeding 1 kVA.
C critical electrical equipment (life-support).

(5 × 1) (5)

2.2 Name the electricity supply system where the consumer earth is directly connected to the supply source earth. (1)

2.3 Name TWO typical applications of the IT electricity supply system. (2)

2.4 Which of the following two systems will need more copper?

TNC system or TNS system (1)

2.5 Briefly explain the TT electricity supply system with regard to earth. (2)

2.6 Name the system that is used in the supply for socket outlets in group 2 medical locations. (1)

[12]

QUESTION 3: SANS 60079-0: ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES PART 0 – GENERAL REQUIREMENTS

Write short notes on the following:

3.1 Mounting of luminaries (2)

3.2 Interlocking devices for socket outlets and plugs (4)

3.3 Lock-out mechanisms for isolators suitable for use with gas group 1 atmospheres (2)

3.4 Enclosures constructed out of light metal compositions for use in a zone 1 area (2)

[10]

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QUESTION 4: SANS 10108 – THE CLASSIFICATION OF HAZARDOUS LOCATIONS AND THE SELECTION OF APPARATUS FOR USE IN SUCH LOCATIONS

4.1 In the petroleum industry, the class of a flammable liquid is determined by its closed-cup flash point.

Choose the description of a closed-cup flash point from COLUMN B that matches the class of flammable liquid in COLUMN A. Write only the letter (A–G) next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.1.1	Class I	A	liquids that have flash points that do not exceed 21 °C
4.1.2	Class II(1)	B	liquids that have flash points that exceed 21 °C but that do not exceed 55 °C and that are handled above their flash point
4.1.3	Class II(2)	C	liquids that have flash points that exceed 55 °C but that do not exceed 100 °C and that are handled below their flash point
4.1.4	Class III(1)	D	liquids that have flash points that exceed 55 °C but that do not exceed 100 °C and that are handled above their flash point
4.1.5	Class III(2)	E	liquids that have flash points that exceed 21 °C but that do not exceed 55 °C and that are handled below their flash point
		F	liquids that have flash points that exceed 100 °C
		G	liquefied petroleum gases (LPGs)

(5 × 1) (5)

4.2 As a master installation electrician, you are required to determine the air changes to be introduced in the battery-charging station to prevent an explosive atmosphere inside the battery-charging station.

The following information is known:

- A battery of 150 cells that has an overcharge current equal to 20 A
- Dimensions of the charging station is 4,0 m × 4,0 m × 4,0 m
- Batteries and stand are occupying approximately 4,0 m^3 of the station
- The rate of release of hydrogen for lead-acid cells are 0,000455 m^3 per hour

Using the above information, calculate the percentage concentration of hydrogen gas in the charging station after 1 hour of charging. (5)

[10]

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QUESTION 5: GENERAL

Keep in mind that the following industries have potentially explosive atmospheres when answering the questions.

5.1 What would be the criteria before a restaurant where gas stoves are used would be considered a hazardous area? (2)

5.2 Oil refineries, oil rigs and processing plants:

Name the THREE zones which are the most likely to be found in these industries. (3)

5.3 Gas pipelines and distribution centres:

What role does cathode protection play or what purpose does it serve in this industry? (3)

5.4 Metal-surface grinding, especially aluminium dust and particles in a fabrication workshop:

Name the liquid and the explosive gas it generates when coming into contact with the products widely used, manufactured or handled in this industry. (2)

5.5 Spray booths (finishing-process areas):

According to SANS 10108 spray booths (finishing-process areas) are considered as zone 1 areas.

Name THREE things that can be done to change the zoning on the inside of spray booths to safe areas, without changing the process (applying paint containing flammable vapours by means of compressed air). (3)

5.6 Explain the phenomenon known as *fire damp* found in the coal-mining industry. (2)

[15]

QUESTION 6: SANS 61241-4: ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES PART 0 – GENERAL REQUIREMENTS

ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST, PART 4: TYPE OF PROTECTION PD

6.1 Classified areas are divided into zones based upon the frequency and duration of the occurrence of explosive dust/air mixtures. Dust layers should also be taken into consideration.

Name and describe THREE of these zones. (11)

6.2 Describe TWO methods that can be used to isolate the electrical power supply to an enclosure in the event of loss of pressure. (4)

[15]

QUESTION 7: SANS 10123: 2014 THE CONTROL OF UNDESIRABLE STATIC ELECTRICITY

7.1 The following is an extract from the standard SANS 10123. Choose the correct option from those given in brackets. Write only the answer next to the question number (7.1.1–7.1.10) in the ANSWER BOOK.

If earthing personnel and mobile apparatus are unavailable, install an antistatic or conductive floor having a resistance to earth not exceeding 7.1.1 (1 MΩ/0,5 MΩ) when measured in accordance with the relevant method. If electrical apparatus is used in a room, install an antistatic floor, having a resistance to earth of at least 7.1.2 (500 kΩ/50 kΩ) to reduce the danger of electrocution to personnel. An 7.1.3 (unearthed/earthed) floor will reduce still further the danger of electrocution. Floors of concrete, magnesite and 7.1.4 (nonconductive/conductive) or antistatic rubber or plastics may be suitable for this purpose when they are constructed to fulfil the requirements of this subsection. Take care to avoid contamination of the floor with oils, resins, waxes or any other material likely to impair its conducting properties.
Where the danger of electrocution does not exist, e.g. because of the complete absence at all times of electrical apparatus, a 7.1.5 (conductive/nonconductive) floor, having no lower limit of resistance to earth, may be used. When a conductive floor is used, ensure that the electrical system is designed to take account of the 7.1.6 (high/low) earth resistance.
When two electrostatically-charged bodies are separated, an electrical stress (expressed in terms of field strength or potential gradient) is 7.1.7 (relieved/created) that tends to 7.1.8 (repel/reunite) the charges and opposes further separation. Energy has therefore been applied to the system to bring about this 7.1.9 (union/separation) and part of the energy is contained in the electric stress so formed. When the electric stress exceeds the breakdown strength of the medium between the separated bodies, a static 7.1.10 (charge/discharge) will occur. (10)

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7.2 Static electricity could be one of the potential ignition sources in a flammable/ combustible atmosphere.

Name FOUR factors that will enable static electricity to become an ignition source. (4)

7.3 State the maximum resistance allowed between an object constructed from conductive material and the general mass of the earth. (1)
[15]

QUESTION 8: GENERAL APPLICATION

Explosion-protected electrical equipment has undergone a change as far as markings are concerned.

Choose the new marking from COLUMN B that matches the old marking in COLUMN A. Write only the letter (A–G) next to the question number (8.1–8.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
8.1	Ex tDA21 IP65 T225 °C	A	Ex de IIC T4 Gb
8.2	Ex de IIC T4	B	Ex d IIB T4 Gb
8.3	Ex ia IIC T4	C	Ex ia IIC T4 Ga
8.4	Ex d [ia] IIC T6	D	Ex tb IIIC T225 °C Db
8.5	Ex d IIB T4	E	Ex d [ia Ga] IIC T6 Gb
		F	Ex de IIC T4 Ge
		G	Ex d [ia Ga] IIC T6 Gc

(5 × 1) **[5]**

TOTAL: 100

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