higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NONNATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY

SPECIALISED ELECTRICAL INSTALLATION CODES

(First paper)

(8080654)

6 April 2021 (X-paper)
09:00–12:00

This question paper consists of 6 pages and an information sheet of 3 pages.

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

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

Define the following terms:

1.1 Employer (3)

1.2 Employee (3)

1.3 Workplace (1)

Complete the following definition:

1.4 Reasonably practicable means practicable having regard to … (5)
[12]

QUESTION 2:

2.1 What is the duty of an employer with regard to the following?

2.1.1 Working environment for his/her employees (2)

2.1.2 Compliance with the act for his/her employees (3)

2.2 What are the general duties of self-employed persons to persons other than their employees? (3)
[8]

QUESTION 3: SANS 60079-10-1: 2016 EXPLOSIVE GAS ATMOSPHERES

3.1 Define *area classification.* (3)

3.2 Who should carry out area classification? (3)

3.3 Fill in the missing words of the following definition. Write only the answers next to the question number (i–vi) in the ANSWER BOOK.

The competency of the person involved in the process of area classification shall be (i) … to the nature of the (ii) … and (iii) … used for carrying out the area classification. Appropriate (iv) … education or training should be (v) … by personnel on a (vi) … basis where required. (6 × 1) (6)
[12]

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QUESTION 4: SANS 60079-10-2: 2018 EXPLOSIVE DUST ATMOSPHERES

4.1 Describe the scope of this code. (3)

4.2 Define the term *explosive dust atmosphere.* (2)

4.3 Name the THREE dust zones in explosive environments. (3)

4.4 In explosive dust environments, how would one control the formation of dust layers? (3)

[11]

QUESTION 5: SANS 60079-0: 2019 EXPLOSIVE ATMOSPHERES GENERAL REQUIREMENTS

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letters (A–J) next to the question number (5.1–5.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
5.1	Encapsulation	A	Ex-i
5.2	Dust (protection by enclosure)	B	Ex-d
5.3	Special protection	C	Ex-o
5.4	Increased safety	D	Ex-p
5.5	Intrinsic safety	E	Ex-q
5.6	Oil immersion	F	Ex-m
5.7	Powder/sand-filled	G	Ex-s
5.8	Pressurisation	H	Ex-n(nA)
5.9	Non-sparking	I	Ex- ‘t’
5.10	Flameproof	J	Ex-e

(10 × 1) **[10]**

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QUESTION 6: SANS 10123: 2014 THE CONTROL OF UNDESIRABLE STATIC ELECTRICITY

6.1 A danger of fire or explosion is not necessarily created by the generation or presence of static electricity, but such danger will arise if all four other conditions are fulfilled.

Discuss the FIVE conditions. (5)

6.2 What governs the ability of the discharge of static to produce ignition? (2)

6.3 The requirements for robustness and corrosion resistance of earthing conductors dictate that the resistance of an installed conductor will be of the order of a few ohms.

6.3.1 Describe how these conductors should be. (2)

6.3.2 How should these conductors be attached? (2)

[11]

QUESTION 7: SANS 10142-1-1: 2018 LOW-VOLTAGE INSTALLATIONS IN MEDICAL LOCATIONS

7.1 In group 2 medical locations, at least one separate medical IT system of electricity supply is necessary. This medical IT system shall be equipped with an insulating-monitoring device.

What are the requirements with regard to the insulation-monitoring device for this system? (6)

7.2 Explain what is meant by *applied part* in medical locations. (4)

[10]

QUESTION 8: SANS 10108: 2017 THE CLASSIFICATION OF HAZARDOUS LOCATIONS AND THE SELECTION OF EQUIPMENT FOR USE IN SUCH LOCATIONS

8.1 Describe the scope of this standard. (6)

8.2 What does this standard not cover? (4)

[10]

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QUESTION 9: GENERAL
Explosion-protected equipment selection and use in hazardous locations

9.1 Explain the following equipment marking: Ex-d I T1.

What does each section of this marking indicate? (4)

9.2 Complete the questions about the GAS GROUP and the TEMPERATURE CLASS for the equipment in TABLE A on the following page by making use of the chemical properties from TABLE A.1 in the information sheet (attached).

Write only the answer (a–d) next to the number (9.2.1–9.2.3) in the ANSWER BOOK. (12)
[16]

TOTAL: 100

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Table A

Equipment selection and verification for hazardous locations

Equipment		Hazardous Location Information							Yes/No?	
		Classification		Chemical	Gas Group		Temperature Class			
Example:										
Ex nA IIB T2		Zone 1	(a) ……?	Illuminating Paraffin	IIA	(b) ……?	T3 (210)	(c) …….?	(d) ……?	
Question:		Can Ex-nA be used in Zone 1?			Can Gas Group IIB equipment be used in a Gas Group IIA environment?		Can T2 equipment be used in an environment where chemicals ignite at T3?		Can this equipment be used in a hazardous location?	
Answers		(a)	**No**		(b)	**Yes**	(c)	**No**	(d)	**No**
Temperature in ºC T1 = 450 T2 = 300 T3 = 200 T4 = 135 T5 = 100 T6 = 85										
9.2.1	Ex-ib IIB T6	Zone 1	(a) ……?	Octane	IIA	(b) ……..?	T3 (429)	(c) …….?	(d) ……?	
9.2.2	Ex-m IIB T4	Zone 2	(a) ……?	Ethyl Nitrite	IIA	(b) ……..?	T6 (90)	(c) …….?	(d) ……?	
9.2.3	Ex-o IIB T2	Zone 1	(a) ……?	Carbon Disulphide	IIC	(b) ……..?	T6 (100)	(c) …….?	(d) ……?	

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INFORMATION SHEET **SANS 10108:2005 Edition 5**

Table A.1: Properties of certain flammable industrial gases and vapours

1	2	3	4	5	6
Gas (substance)	**Ignition temperature °C**	**Explosive limit in air % (volume fraction)**		**Typical flash point °C**	**Relative density (air = 1)**
		Upper	**Lower**		
Group I					
Methane	537	15,0	5,0	-188	0,55
Methane and coal dust	150	15,0	5,0	-	0,55
Flammable gas[8] (methane and other hydrocarbon mixtures)	-	22,0b	4,5b	-	-
Subgroup IIA					
Blast-furnace gas	-	70,0	28,0	-	-
Propane	465	9,5	2,0	<-6,7	1,5
Petrol	560	8,0	1,2	-45	2,8
Diesel	257	7,5	0,6	>55	>1
Illuminating paraffin or kerosene	210	8,9	1,4	95	>1
Power kerosene	-	<5,0	>0,7	>38	>1
Butane	430	8,5	1,5	<-6,7	2,0
Pentane	309	7,5	1,5	<-51,0	2,5
Hexane	260	7,0	1,0	<-29,0	3,0
Heptane	233	6,0	1,0	-1,1	3,5
iso-Octane	530	3,5	0,5	-12,2	3,9
Decane	250	-	0,5	46,0	4,9
Benzene	538	8,0	2,0	-11,1	2,7
Xylene	482	6,0	1,0	25,0	-
Cyclohexane	285	8,5	1,0	0	2,9
Acetone	538	13,0	3,0	-9,4	2,0
Ethyl-methyl ketone	515	12,0	2,0	1,7	2,5
Methyl acetate	454	15,5	3,0	-10,0	2,5
Ethyl acetate	427	11,5	2,0	7,2	3,0
n-Propyl acetate	450	8,0	1,5	4,5	3,5
n-Butyl acetate	421	-	1,5	40,5	4,0
Amyl acetate	398	-	1,0	34,4	4,5
Chloroethylene	413	16,0	6,2	13,3	3,4
Methanol	464	36,5	5,5	18,3	1,1
Ethanol	423	19,0	2,5	18,3	1,6
Butanol	-	-	-	23,9	2,6
iso-Butanol	427	-	1,5	27,8	2,6
n-Butanol Amyl	343	-	1,5	28,9	2,6
alcohol	371	-	1,0	52,8	3,0
Ethyl nitrite	90	50,0	3,0	-35,0	2,6
Ammonia	651	27,0	15,0	-	0,59

a. Group I: electrical apparatus for mines susceptible to flammable gas.

b. Group II: electrical apparatus for places with a potentially explosive atmosphere, other than mines susceptible to flammable gas.

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INFORMATION SHEET **SANS 10108:2005 Edition 5**

Table A.1 (continued)

1	2	3	4	5	6
Gas (substance)	**Ignition temperature** °C	**Explosive limit in air** % (volume fraction)		**Typical flash point** °C	**Relative density** (air=1)
		Upper	**Lower**		
Subgroup IIB					
Ethylene	**450**	**35,0**	**2,5**	**< -6,7**	**0,97**
Diethyl-ether	**180**	**48,0**	**1,5**	**-40,0**	**2,6**
Ethylene oxide	**429**	**80,0**	**3,0**	**< -17,8**	**1,5**
Carbon monoxide	**651**	**75,0**	**12,0**	-	**0,96**
Buta-1:3-diene	**450**	**12,0**	**2,0**	-	**1,9**
Coal gas (town gas)ct	**649**			-	-
Coke-oven gas	-	**31,0**	**5,5**	-	-
		34,0	**4,4**		
Subgroup IIC					
Acetylene	**337**	**82,0**	**2,5**	-	**0,90**
Carbon disulphide	**100**	**50,0**	**1,0**	**-30,0**	**2,6**
Hydrogen	**585**	**74,0**	**4,0**	-	**0,07**
Water gas	-	**70,0**	**6,0**	-	-
Ethyl nitrate	-	-	**3,0**	**10,0**	**3,1**

a. Group I: electrical apparatus for mines susceptible to flammable gas.
b. Group II: electrical apparatus for places with a potentially explosive atmosphere, other than mines susceptible to flammable gas
c. The use of group IIB apparatus is indicated when a mixture of carbon monoxide with air is saturated with moisture, or when small quantities of hydrocarbons appear in the mixture (worst case).
d. Town gas and coke-oven gas are mixtures of hydrogen, carbon monoxide and methane. If the sum of the concentrations of hydrogen and carbon monoxide is less than a volume fraction of 75% of the total, then flameproof apparatus of group IIB is recommended, otherwise apparatus of group IIC is recommended. For all concentrations, group IIC intrinsically safe apparatus is recommended.

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