higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NON-NATIONAL CERTIFICATE

SPECIALISED ELECTRICAL INSTALLATION CODES

(First paper)

(8080654)

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

This question paper consists of 8 pages and 3 information sheets.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

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

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QUESTION 1: OCCUPATIONAL HEALTH AND SAFETY ACT, 85 of 1993

1.1 Define the term, *inspection authority.* (5)

1.2 Complete the following sentences by writing only the missing word or words next to the question number (i)–(x) in the ANSWER BOOK.

The findings by an inspection authority may be about the following:

the question of whether any particular (i) … has been or is being (ii) … with, with respect to any (iii) …, article, substance, plant or machinery, or with (iv) … to work or a condition (v) … on or in any (vi) …, or with respect to any other matter, and by issuing a (vii) …, stating such (viii) …, to the (ix) … to whom the (x) … is rendered.

(10 × 1) (10)

[15]

QUESTION 2: SANS 60079-10-1:2016 EXPLOSIVE GAS ATMOSPHERES

2.1 What is a *hazardous area* (on account of explosive gas atmospheres) according to this standard? (3)

2.2 What do you understand by the term, *zones*, according to this standard? (2)

2.3 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.3.1–2.3.3) in the ANSWER book.

2.3.1 Primary grade of release can also be referred to as a zone 2 area.

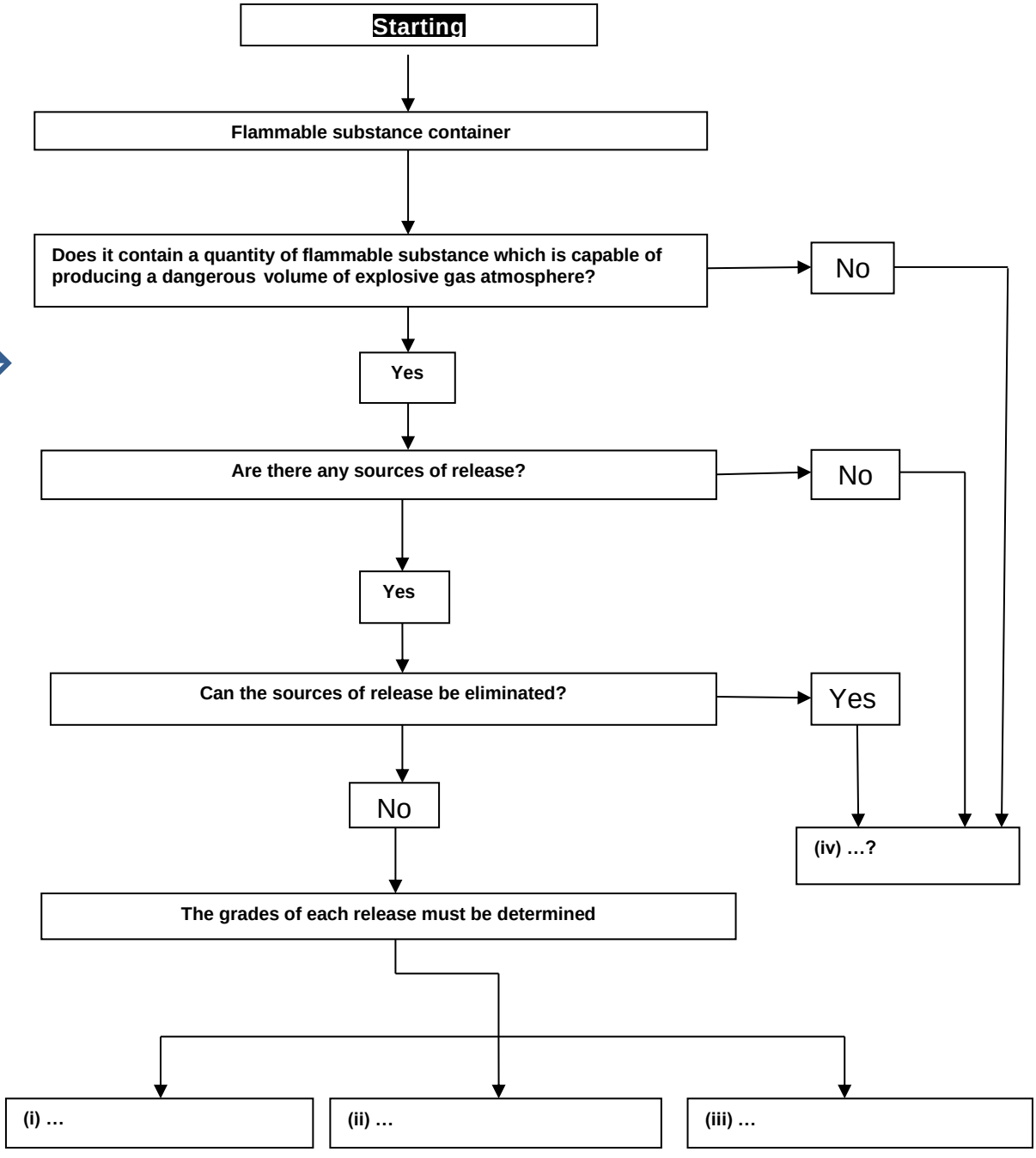
2.3.2 A zone 1 area can also be referred to as a secondary grade of release.

2.3.3 A continuous grade of release can also be referred to as a zone 0 area.

(3 × 1) (3)

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2.4 Study the flow chart on the approach to classification of hazardous areas below and then fill in the missing area classifications by writing only the answers in their correct order next to the number (i)–(iv) in the ANSWER BOOK. (3)



2.5 What is the classification at (iv)? (1)

[12]

QUESTION 3: SANS 60079-10-2: 2018 EXPLOSIVE DUST ATMOSPHERES

3.1 Scope of this standard:

Complete the following:

3.1.1 This standard does not apply to where a …

3.1.2 This standard does not take into account …

(2 × 2) (4)

3.2 Area classification procedure for explosive dust atmospheres:

Area classification is based on a number of factors and may require informed input from a number of sources.

Name FIVE of these factors. (6)

[10]

QUESTION 4: SANS 60079-0: 2019 EXPLOSIVE ATMOSPHERES GENERAL REQUIREMENTS

4.1 Choose a description from COLUMN A that matches the Ex marking in COLUMN B. Write only the letter (A–H) next to the question number (4.1.1–4.1.8) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.1.1	Lowest temperature (of a surface) at which, under specified conditions (according to IEC 60079-20-1), an ignition of a flammable gas or vapour in mixture with air or air/inert gas occurs	A	minimum ignition temperature of an explosive gas atmosphere
4.1.2	Highest temperature which is attained in service under the most adverse conditions (but within the specified tolerances) by any part or surface of Ex Equipment	B	minimum ignition temperature of a dust layer
4.1.3	Lowest temperature of a heated surface which, under specified conditions according to IEC 60079-20-1, will ignite a flammable substance in the form of a gas or vapour mixture with air	C	auto-ignition temperature (AIT)
4.1.4	Lowest temperature of a hot surface at which ignition occurs in a dust layer under specified test conditions	D	minimum ignition temperature of a dust cloud
4.1.5	Lowest temperature of a hot surface on which the most ignitable mixture of the dust with air is ignited under specified test conditions intrinsic safety	E	maximum surface temperature
4.1.6	Temperature of the air or other media, in the immediate vicinity of the equipment or component	F	ambient temperature
4.1.7	Certificate prepared for Ex Equipment	G	Ex Component certificate
4.1.8	Certificate prepared for an Ex Component	H	Ex Equipment certificate

(8 × 1) (8)

4.2 What does the symbol 'U' on the IA number of an IA certificate for an Ex Component mean or is prepared for? (2)

[10]

QUESTION 5: SANS 10123: 2014 THE CONTROL OF UNDESIRABLE STATIC ELECTRICITY

5.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (5.1.1–5.1.5) in the ANSWER BOOK.

5.1.1 Static electricity is not of common occurrence but often causes danger, discomfort, or inconvenience.

5.1.2 Under some conditions, electrostatic voltages can reach a value in excess of the dielectric strength of air (or other medium) and a spark discharge then occurs.

5.1.3 Hazardous conditions exist where a discharge is liable to occur in areas containing flammable materials.

5.1.4 In other instances, static electricity presents a danger and can cause operational problems during manufacturing or handling processes.

5.1.5 Articles sticking to each other or neighbouring objects, and the attraction of dust and foreign material are common examples.

(5 × 1) (5)

5.2 Describe, *induction of static electricity*. (7)

[12]

QUESTION 6: SANS 10108: 2017 THE CLASSIFICATION OF HAZARDOUS LOCATIONS AND THE SELECTION OF EQUIPMENT FOR USE IN SUCH LOCATIONS

6.1 Define, *accredited test laboratory,* according to this standard. (4)

6.2 Which areas or locations in underground coal mines shall be regarded as hazardous in terms of the relevant national legislation? (3)

6.3 Classification by direct example: Battery rooms and battery charging bays

Describe the dangers that can be posed by secondary lead acid vented or valve-regulated type batteries frequently used in large-scale uninterrupted power supply (UPS) installations. (7)

[14]

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QUESTION 7: GENERAL: EXPLOSION-PROTECTED EQUIPMENT SELECTION AND USE IN HAZARDOUS LOCATIONS

7.1 Explain the following equipment marking: Ex ia IIB T5 Ga

What does each section of this marking indicate? (5)

7.2 By using of the chemical properties Table A.1 (pg.1 and 2) (attached), answer the questions about the Protection Type, Gas Group and the Temperature Class for the equipment, from Table A (Equipment selection and verification for hazardous locations) (attached).

Give reasons for all the 'No' answers given in 7.2.1 to 7.2.3 by writing only the answer (a)–(d) next to the number (7.2.1–7.2.3) in the ANSWER BOOK.

(22)
[27]

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 ic IIB T2		Zone 1	**(a)** …?	Illuminating Paraffin	IIA	**(b)** …?	T3 (210)	**(c)** …?	**(d)** …?
Questions:		Can Ex ic be used in Zone 1?			May a Gas Group IIB equipment be used in a Gas Group IIA environment?		May T2 equipment be used in an environment where chemicals ignite at T3?		May this equipment be used in the 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									
7.2.1	Ex ib II T4	Zone 0	(a) **No**	Ethylene Oxide	IIB	(b) Yes	T2 (429)	(c) Yes	(d) **No**
7.2.2	Ex e IIB T2	Zone 1	(a) Yes	Carbon Disulphide	IIC	(b) **No**	T6 (100)	(c) **No**	(d) **No**
7.2.3	Ex s IIA T2	Zone 1	(a) Yes	Hexane	IIC	(b) Yes	T3 (260)	(c) **No**	(d) **No**
7.2.4	Ex q IIB T3	Zone 2	(a) Yes	Ethanol	IIA	(b) Yes	T2 (423)	(c) Yes	(d) Yes

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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[a] (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	343	-	1,5	28,9	2,6
Amyl 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 *(concluded)*

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 Ethylene	**180**	**48,0**	**1,5**	**-40,0**	**2,6**
oxide	**429**	**80,0**	**3,0**	**< -17,8**	**1,5**
Carbon monoxide Buta-	**651**	**75,0**	**12,0**	**-**	**0,96**
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 Ethyl	**-**	**70,0**	**6,0**	**-**	**-**
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 11B 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 11B is recommended, otherwise apparatus of group IIC is recommended. For all concentrations, group IIC intrinsically safe apparatus is recommended.

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