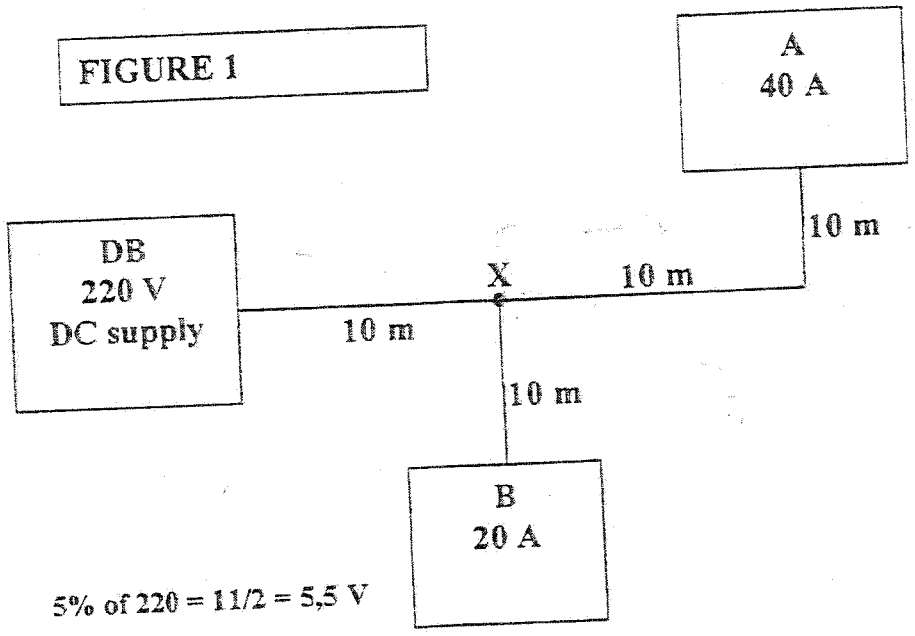
QUESTION 1
SANS 10142 part 1 of 2003 CLAUSE 8
COMPULSORY

Determine from figure 1 as attached the following :

FIGURE 1



5% of 220 = 11/2 = 5,5 V

$$VD = I \times \frac{\rho l}{A}$$

$$\therefore A = \frac{I \times \rho l}{VD}$$

$$A = \frac{40 \times 0{,}022 \times 30}{5{,}5}$$

$$A = 4{,}8mm^2$$

1.1 Say 6 mm² which is 0,0073 (1)

VD from X to A	= 0,0073 x 40 x 20	= 5,84 V
VD from X to B	= 0,0073 x 20 x 10	= 1,46 V
VD from DB to X	= 0,0073 x 60 x 10	= 4,38 V

1.2 VD from DB to A = 5,84 + 4,38 = 10,22 V (2)

1.3 VD from DB to B = 1,46 + 4,38 = 5,84 V (2)

1.4 % VD worse condition = (10,22 ÷ 220) x 100 = 4,645% (2)

1.5 Main protection level = 40 ÷ 20 = 60 nearest is 63 A (1)

1.6 First calculate ρ DB to X $\rho = \frac{4.38 \times 6 \div 2}{60 \times 10} = 0.0219 \mu\Omega \times m$ (2)

[10]

Then ρ X to A $= \frac{5.84 \times 6 \div 2}{40 \times 20} = 0.0219 \mu\Omega \times m$

From ρ X to B $= \frac{1.46 \times 6 \div 2}{20 \times 10} = 0.0219 \mu\Omega \times m$

QUESTION 2
SANS 10142 PART 1 OF 2003
Conductors in conduit

2.1 Determine how many 2.5mm ² single multi-strand PVC conductors may be added to the following installation, by making use of the attached tables according to the code.

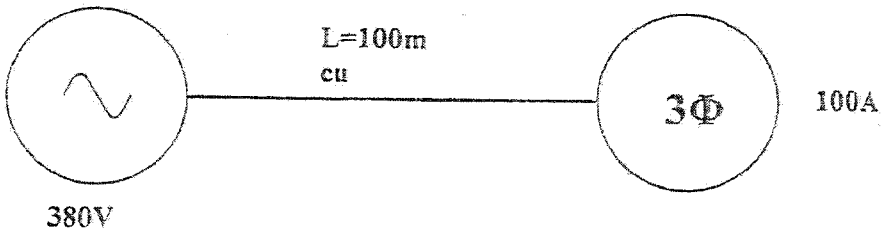
- 25 mm = 144 value of K
- 2 x 1,5 mm^2 = 20 value of C
- 3 x 4 mm^2 = 52 value of C
- 1 x 6 mm^2 = 22 value of C

Total value of C = 237
Spare capacity = 237 – 144
= 93
But 2,5 mm^2 value of C = 14
Thus number of 2,5 mm^2 conductors = 93/14
= 6,64

Only 6 may be added (3)

2.2 TV = 2 x Icb x Recc
Thus Recc = (3,6 ÷ 1000) x 69,4
Recc = 0,2484

Icb = 30 ÷ (2 x 0,2484
= 60.3864 A
Icb = say 60 A (2)



$$VD = \frac{mv}{1000} \times I \times L$$

$$19 = \frac{X}{1000} \times 100 \times 100$$

$$X = \frac{19 \times 1000}{100 \times 100}$$

X = 1,9 is value which is a 25mm² cu cable

Test: VD = (mv/1000) x I x L
VD = (1.5/1000) x 100 x 100
VD = 15V
Cable size is 25 mm² (3)

2.4 According to Table 6.6, a 25mm² cable can go up to 119 Amps when buried in the ground. (2)
[10]

QUESTION 3

3.1	Recommended installation method for new installations	(1)
3.1.1	The wiring is suitably protected against mechanical damage	(2)
3.1.2	The wiring is suitably protected against mechanical damage	(2)
3.1.3	The wiring is suitably protected against mechanical damage	(1)
3.2.1	Building elements such as walls, rafters or purlins	(1)
3.2.2	Be at least 3 m above floor level	(1)
3.2.3	Where they enter conduit or other building elements	(1)
3.2.4	Does not impair the conductor insulation	(1)
		[10]

QUESTION 4
SANS 10142 PART 1 of 2003
WIREWAYS
General , name the installation requirements in the following instances.

6.5.1.1 When a wireway is installed,

a) the wireway shall be installed such that safe maintenance is ensured;

b) joints other than expansion joints shall be at least as rigid as the wireway itself;

d) expansion joints shall protect the wiring at least as well as the rest of the wireway does;

e) all inspection joints and boxes shall be easily accessible, even if they are above ceilings or below floorboards;

f) all boxes and expansion joints that could be splashed with liquid shall have covers that prevent the liquid from entering the wireways;

g) it shall be able to withstand the environmental conditions in which it is installed;

i) no part of the wireway shall be flattened, split or damaged;

j) metal doors, covers or hinged panels shall be separately earthed where any electrical equipment is fitted to such doors, covers or panels;

l) cable entry points, exit points, and internal surfaces of the wireway shall not be able to damage the insulation of cables installed.

6.5.2.2 Electrical continuity

All parts of rigid metallic wireways shall be bonded to earth.

[10]

QUESTION 5
SANS 10142 PART 1 OF 2003
Positioning and fixing of cables.

(4) 9

Name FOUR instances where the installation or the running of a cable is prohibited in the following cases:

A cable shall not be run

in the same trench or wireway as a supplier's cable, except with the supplier's permission,

where it is likely to be damaged by liquids such as oil, acid, acetone and alkali or by gases such as sulfur dioxide,

within 150 mm of hot services such as hot pipes and flues if the heat is likely to damage the cable, unless the cable is cooled or shielded from heat, or

in a position where it is likely to be damaged, unless it is mechanically protected.

5.5 **Buried cables: Fill in the missing word.**
5.5.1 **Unarmoured cables may be buried .....**

Unarmoured cables may be buried if they are insulated and sheathed.

5.6 **Distribution boards**
Each distribution board shall be controlled by a switch disconnector
Name the general requirements, it shall comply with in the following instances:

be mounted in or next to the distribution board,

in the case of the main or first distribution board of an installation, be labelled as "main switch",

in the case of a sub-distribution board, be labelled as "sub-main switch" or "main switch" if the board is labelled "sub-board ...",

in the case where an alternative supply is installed (emergency supply, uninterruptible power systems (UPS), etc.), be labelled as required

have a danger notice on or near it. The danger notice shall give instructions that the switch-disconnector be switched off in the event o inadvertent contact or leakage.

[10]

QUESTION 6
SANS 10142 PART 1 OF 2003 (LUMINAIRES)

6.1 **Name the FIVE places a suspended luminaire shall be mounted out of arms reach from the floor if it is installed.** (5)

A suspended luminaire shall be out of arm's reach from the floor if the luminaire is installed in a

a) washroom,

b) change room,

c) laundry,

d) cupboard or other enclosure, or

e) position exposed to wind and the weather.

A suspended luminaire that is likely to be exposed to wind shall be specially designed for such conditions and so installed that it cannot be damaged or come into contact with flammable material.

6.2 **LAMP HOLDERS**

6.2.1 **A lamp holder shall be shrouded in insulating material or shall be earthed unless it meets with simultaneous installation requirements. Name FOUR such simultaneous instances.** (4)

Lamp holders

A lamp holder shall be shrouded in insulating material or shall be earthed, unless it is simultaneously

a) out of arm's reach from the floor or walkway level,

b) out of arm's reach from a structure that is bonded to earth,

c) protected from the weather and the splashing, dripping, or accumulation of water, and

d) not touching a conductive surface.

6.2.2 Name the connecting requirements regarding Edison screw type Lamp holders. (1)
[10]

The outer contact of an Edison-screw type lamp holder shall be connected to the neutral conductor.

QUESTION 7
SANS 10142 PART 1 OF 2003

6

7.1 Calculate the PSCC of a DC supply installation if the following information is given :

- 100 cell battery with a full load capacity of 400a/h
- Total internal resistance per cell is 0,011ohm
- Total resistance of the battery pole connectors is 1 ohm
- Total cable length is 100m
- Cross sectional area of supply cable is 16mm² copper
- Ignore method of installation

(9)

$$EB = 1{,}05 \times 2 \ volts/cell$$

$$EB = 1{,}05 \times 2 \times 100 = \underline{210V}$$

$$R_B = 100 \times 0{,}011 = \underline{1{,}1\Omega}$$

$$R_{BL} = \underline{1\Omega}$$

$$PSCC = \frac{EB(amps)}{R}$$

$$PSCC = \frac{210}{(0{,}9 \times 1{,}1) + 1 + 2(0{,}0014 \times 100)}$$

$$\underline{PSCC = 92{,}522 Amps}$$

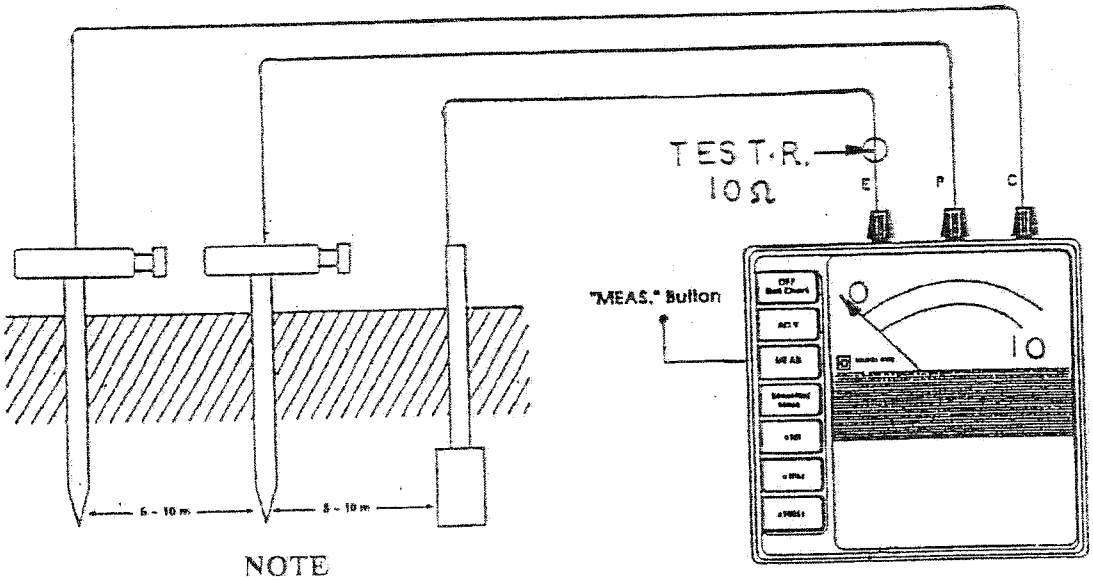
7.2 Describe the classification of the location for the above installation? (1)
[10]

It is a hazardous area due to the toxic and flammable gas of the battery acid

QUESTION 8
SANS 10142 PART 1 OF 2003
VERTIFCATION AND CERTIFICATION

8.1 Describe with the aid of a diagram how the earth electrode resistance test is carried out . (4)

Earth Resistance Measurement



NOTE
ANY OTHER CORRECT
ANSWER WILL BE EXCEPTED

8.2 Give the formula to enchance your answer. (1)

NOTE

It is accepted that a circuit should carry a fault current of twice the rated circuit current. To calculate what the maximum acceptable value of measurement is proceed as per the following formula:

$$R_{max} = \frac{V}{2I}$$

Where Rmax = Maximum earth electrode resistance
V = System Voltage
I = Rated Circuit Current

Example: 60 Amp Circuit (I)
220 VAC System (V)

$$R_{max} = \frac{V}{2I}$$

$$= \frac{220}{(2 \times 60)}$$

$$= 1.83\ \Omega$$

Therefore the earth electrode resistance must be below 1.83 Ω to allow a fault current of 120 amps to flow.

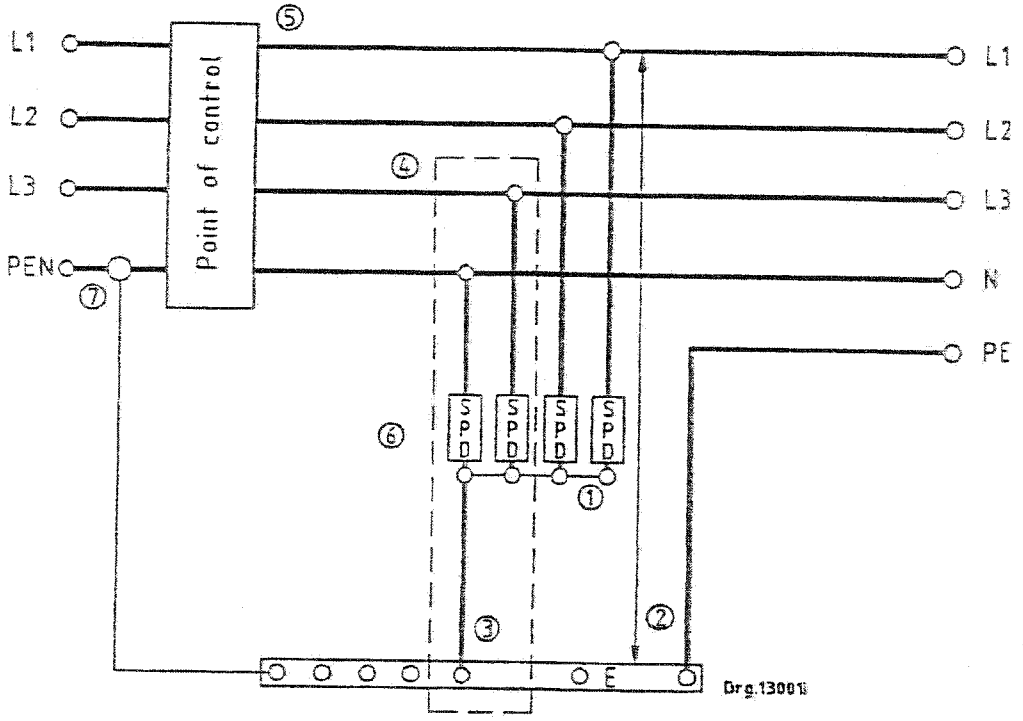
QUESTION 9

SANS 10142: PART OF 1 OF 2003

ANNEXURE L

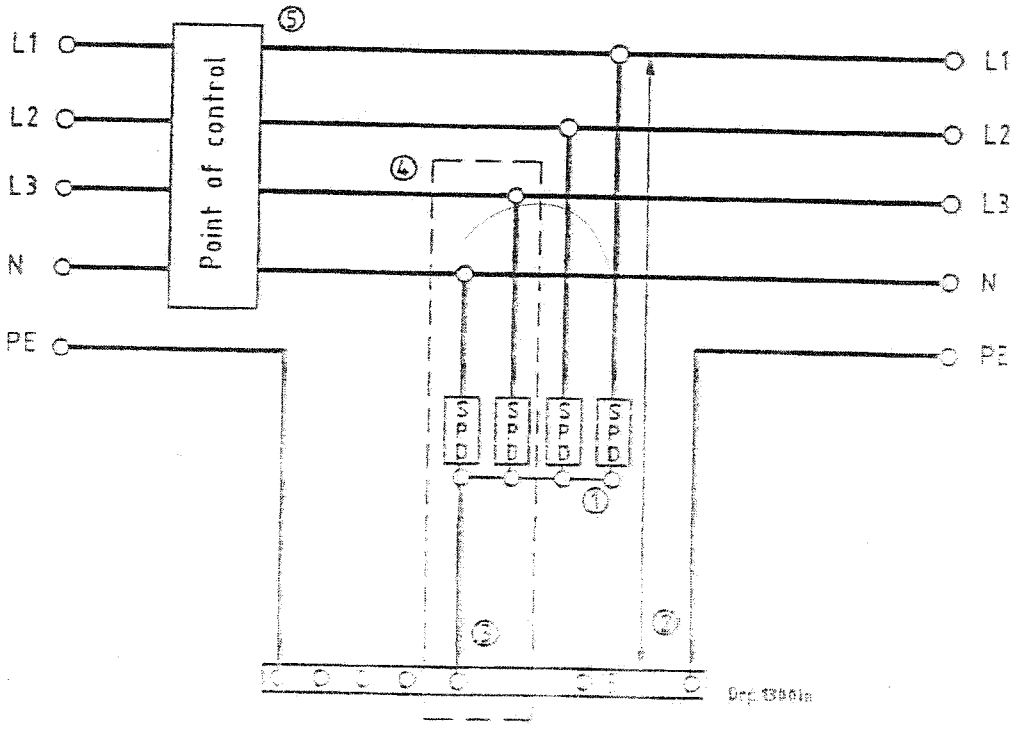
INSTALLATION OF SURGE PROTECTION DEVICE (SPD's) FOR LOW VOLTAGE SYSTEMS

9.1 Draw a circuit of a single phase installation which incorporates TWO SPD's for a TN- C-S earthing system (5)



9.2 Draw a circuit of a single phase installation which incorporates TWO SPD's for a TN- S earthing system (5)

[10]



QUESTION 10

SABS 0313 : PROTECTION OF STRUCTURE AGAINST LIGHTNING

10.1 State al the criteria that need to be complied with when installing earth Electrodes, in the following cases.

10.1	**External horizontal ring earth electrodes.**	**(2)**
10.2	**Radial or vertical earth electrodes.**	**(3)**
10.3	**Insulation depth and type of earth electrode.**	**(3)**
10.4	**Joints**	**(1)**
10.5	**Inspections**	**(1)**
		[10]
	TOTAL	**100**

Installation of earth electrodes

An external horizontal ring earth electrode should be buried at a depth of at least 0,5 m but not within 1 m of the walls of the structure.

The radial or vertical earth electrodes shall be installed outside the space to be protected at a depth of at least 0,5 m and distributed as uniformly as possible to minimize electrical coupling effects in the earth.

Earth electrodes shall be so installed as to allow inspection during construction.

The installation depth and the type of the earth electrode shall be such as to minimize the effects of corrosion, soil drying and freezing and thereby stabilize the equivalent earth resistance (see 3.13). It is recommended that the first metre of a vertical earth electrode should not be regarded as being effective under frost conditions.

All joints shall be made in accordance with good engineering practice.