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ANSWER SHEET
SPARKS MAGAZINE: Summer Edition 2021

Earthing Arrangements & Protective Conductors:

(Covering Outcome 2 of Unit 304 (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91)

You may find it helpful to have a copy of BS7671:2018 for reference to answers.

Question 1:
TN-C-S, TN-S and TT are all types of?

Supply system *(See Definitions)*

Question 2:
The 'earthing conductor' is the protective conductor that connects the main earthing terminal (MET), to which other points?

1. In the TT supply system the MET connects to the earth electrode
2. In the TN supply systems the MET connects with the means of earthing *(See Definitions)*

Question 3:
Give **three** examples of suitable earth electrodes that could be installed in a TT installation?

1. Earth rod
2. Earth plate
3. Underground structural metalwork embedded in foundations etc…
   (See Part 5 Chapter 54 Regulation: 542.2.2)

Question 4:
What is minimum cross-sectional area of a buried pvc insulated copper earthing conductor protected by a steel pipe?

From Table 54.1 the minimum size of cable is stated as being $10mm^2$
(See Part 5 Chapter 54 Regulation: 542.3.1)

Question 5:
The cross-sectional area of a protective conductor, other than a protective bonding conductor can be determined by one of two methods, what are the two methods?

1. By calculation using a formula where $S = \sqrt{I^2t} \div k$
2. By selection from Table 54.7
   (See Part 5 Chapter 54 Regulations: 543.1.3 and 543.1.4 respectively)

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Initial Verification Of Electrical Installations:

Covering Unit 607 (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 and the EAL equivalent)

Complete the following questions regarding the principles, practices and legislation for the initial verification of electrical installations.
Note: The reference, (GN) refers to the IET Guidance Note 3 document

1) State **two occasions** when an initial verification can be carried out.

Answer:
During the construction and on completion of the electrical installation
(page15 GN3)

2) Identify **two** aspects of BS7671 that initial verification will confirm.

Answer:
Initial verification will confirm compliance with the design and construction requirements of the installation.
(page15 GN3)

3) When an inspector carries out an initial verification explain why inspection and testing can only be ***'so far as is reasonably practicable'***?

Answer:
For example: It would not be possible for an inspector to confirm that the correct size circuit cable has been installed throughout its length due to the cable being buried or enclosed within the fabric of the building and therefore cannot be seen.. However the inspector will be able to confirm the correct cable size at a distribution board.
(page15 GN3)

4) Identify the **three** BS7671 generic requirements for items to be verified during the initial verification procedure.

Answer:
- *Equipment is the correct type and complies with applicable British Standards, or equivalent*
- *The fixed installation is correctly selected and erected*
- *The fixed installation is not visibly damaged*

(page15 GN3)

5) State the **correct title** of the statutory document that concerns inspection and test records, and identify the length of time records must be kept.

Answer:
The Electricity at Work Regulations 1989: and in particular Regulation 4(2).
The Memorandum of guidance on the Electricity at Work Regulations (HSR25) recommends records be kept for the lifetime of the installation.
(page16 GN3)

6) State who is responsible for comparing and verifying inspection and test results with relevant criteria for an installation.

Answer:
The person responsible for the inspection and testing the electrical installation
(page16 GN3)

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Inspection &Testing Of Electrical Installations:
(Covering Unit 307: (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 and the EAL equivalent)

Practice Multiple-choice questions:

No.	Question.	Answer
1	Which **one** of the following is concerned principally with Part 6 of BS7671?	
a	Electricity at Work Regulations 1989	
b	Building Regulations	
c	Electricity, Safety, Quality and Continuity Regulations	
d	IET Guidance Note 3	**X**

No.	Question.	Answer
2	To enable electrically skilled persons to construct an electrical installation and commission it, the document required is?	
a	IET BS7671:2008	
b	Electricity at Work Regulations 1989	
c	The Specification	**X**
d	Part P of the Building Regulations	

No.	Question.	Answer
3	Precise details regarding the way electrical equipment is to be installed must be obtained from?	
a	The equipment manufacturer	**X**
b	The client	
c	Main contractor	
d	Electricity supplier	

No.	Question.	Answer
4	Electrical test instruments should conform to which of the following British Standards?	
a	HS (G) 141	
b	HSE Guidance	
c	EAWR 1989	
d	BS EN 61010	**X**

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No.	Question.	Answer
5	Electrical shock hazards may arise from isolated parts of an electrical installation, which of the following connected loads require care to be taken?	
a	Resistive loads	
b	Electric heating systems	
c	Voltages on earthed metalwork	
d	Capacitive loads	**X**

No.	Question.	Answer
6	The responsibilities of an electrical inspection and test engineer include each of the following with one exception?	
a	To ensure no danger occurs to persons, livestock and property during testing	
b	To comparing the test results with design criteria	
c	To consider the condition of the installation and advise accordingly	
d	To Issue prohibition notices	**X**

No.	Question.	Answer
7	In the case of a house of multiple - occupancy, the maximum period between inspections and testing is recommended not to exceed?	
a	Annually	
b	Every two years	
c	Every five years	**X**
d	Every ten years	

No.	Question.	Answer
8	When inspecting an installation for the first time the purpose is to verify each of the following except?	
a	No part of the installation is damaged	
b	Test results comply with previously obtained data	**X**
c	Parts of the fixed installation are correctly selected and erected	
d	Installed electrical equipment is of the correct type	

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Electrical Instrument Readings:
(Covering Unit 307: (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 and the EAL equivalent)

In the following exercise match each unit with its measured unit

No.	Unit		Measured Unit
1	Current 4×10^{3}	**A**	**36mA**
2	Voltage 400×10^{3}	**B**	**45kΩ**
3	Resistance 150×10^{2}	**C**	**5kW**
4	Current 36×10^{-3}	**D**	**15kΩ**
5	Resistance 45×10^{3}	**E**	**20MΩ**
6	Power 50×10^{2}	**F**	**400kV**
7	Resistance 20×10^{6}	**G**	**4kA**
8	Time 20×10^{-3}	**H**	**20mS**

Solutions:

1	**G**	**5**	**B**
2	**F**	**6**	**C**
3	**D**	**7**	**E**
4	**A**	**8**	**H**

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End Of Year Revision: Electrical Science & Principles

(Covering Unit 309: 'Understanding the electrical principles associated with the design, building, installation, and maintenance of electrical equipment and systems' (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 or EAL equivalent)

Attempt the following multiple choice questions:

No.	Question.	Answer
1	Three resistors of 10Ω, 25Ω and 55Ω are connected in series with each other. The total resistance will be?	
a	Higher than 80Ω	**X**
b	Higher than 25Ω	
c	Total of 88Ω	
d	Lower than 10Ω	

No.	Question.	Answer
2	Two resistors each having a resistance of 100Ω are connected in parallel with a resistor of 50Ω. The total resistance is?	
a	3.05Ω	
b	13.5Ω	
c	25.0Ω	**X**
d	142Ω	

No.	Question.	Answer
3	The total resistance of a circuit is 150Ω. If the circuit consists of three resistors, and one resistor is 10Ω, what is the total value of the remaining resistors?	
a	140Ω	**X**
b	112Ω	
c	100Ω	
d	9Ω	

No.	Question.	Answer
4	When an alternating current passes through a conductor	
a	Heat is generated	
b	An alternating magnetic field is produced in the conductor	**X**
c	Electrons flow from positive to negative	
d	A magnetic field is set up around the conductor	

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No.	Question.	Answer
5	When current in a conductor is shown by the symbol ⊕ the current is	
a	Alternating	
b	Flowing away from the viewer	X
c	Flowing towards the viewer	
d	Positive	

No.	Question.	Answer
6	If current is flowing as shown in the symbol of question 5 above, the magnetic field produced around the conductor will be?	
a	Moving clockwise around the conductor	X
b	Moving anti-clockwise around the conductor	
c	Passing over the length of conductor	
d	Alternating across the conductor	

No.	Question.	Answer
7	Magnetic flux is measured in?	
a	Webers	X
b	Joules	
c	Farads	
d	Teslas	

No.	Question.	Answer
8	Force acting on a current carrying conductor lying at 90° to a magnetic field is measured in?	
a	Joules	
b	Newtons	X
c	Watts	
d	Webers	

No.	Question.	Answer
9	A conductor 100m long and carrying 5A is lying at 90º to magnetic field of 1.5T, what is the force on the conductor?	
a	750N	X
b	115N	
c	107.5N	
d	100N	

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No.	Question.	Answer
10	Calculate the induced voltage in a 500m long conductor when it is passing through a flux density of 3T at a rate of 3m/s	
a	500V	
b	4.5kV	**X**
c	450V	
d	55.5V	

No.	Question.	Answer
11	What is the resistance of 1000m of 1.5mm² copper cable is if the conductor resistivity is given as 17.2μΩ/mm?	
a	0.85 Ω	
b	0.95 Ω	
c	10.00 Ω	
d	11.47 Ω	**X**

No.	Question.	Answer
12	The electron has what type of electrical charge?	
a	Negative	**X**
b	Positive	
c	None	
d	Equal positive and negative	

No.	Question.	Answer
13	The power factor of an a.c. induction motor is stated as 0.8. If the motor is rated as 30kW what is the apparent power of the motor?	
a	24.00kVA	
b	25.20KVA	
c	52.20kVA	
d	37.50kVA	**X**

No.	Question.	Answer
14	If a distribution circuit cable is supplied at end A with 230v, and resistive loads are taken from it at points B and C, if the overall voltage drop from A to C is 2.6%, the voltage at C will be?	
a	220.03V	
b	224.02V	**X**
c	226.45V	
d	598.78V	

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No.	Question.	Answer
15	If an electric motor has a rated output of 25kW and an efficiency of 78%, the electrical input to the motor will be?	
a	15.60kW	
b	21.00kW	
c	24.00kW	
d	32.05kW	**X**

No.	Question.	Answer
16	An auto- transformer operates on the principle of?	
a	Self -induction	**X**
b	Mutual induction	
c	Impedance	
d	resistance	

No.	Question.	Answer
17	The impedance of a series a.c. circuit is usually expressed in which of the following units?	
a	Watts	
b	Amperes	
c	Volts	
d	Ohms	**X**

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Electro-Technical Science Revision Quiz:
(Covering Unit 302 (Level 3 Diploma in electrical Installations (Buildings & Structures) C&G 2365-03 or EAL equivalent)

True or False:
For each question decide if the answer or statement is true or false. You may need to refer to your notes, text books or, where necessary, complete a calculation to see if the answer is correct or not.

1) Electric current flows when a potential - difference is connected across a completed circuit?

TRUE	✓
FALSE	

2) Conventional electric current flows from the negative to the positive terminal in a circuit supplied by a battery?

Conventional current flows from positive to negative and Electron current flows from negative to positive
Conventional current so called because it was assumed that this was the direction current flowed round a circuit until atomic theory was understood.

TRUE	
FALSE	✓

3) Resistance can be described as a potential-difference across components of a circuit?

Resistance is the opposition to current flow in a circuit and is measured in Ohms (Ω).

TRUE	
FALSE	✓

4) A typical **transmission** voltage is 400 000V or 400kV?

TRUE	✓
FALSE	

5) A **distribution** voltage can be 230V or 400V?

TRUE	✓
FALSE	

6) The resistance of a conductor decreases with increasing length and increases with decreasing cross-sectional-area?

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The resistance of a conductor increases with increased length and does increase with decreasing cross-sectional-area, so half the statement is true, but overall the statement is false.

TRUE	
FALSE	✓

7) Iron and copper losses are normally associated with electrical transformers?

TRUE	✓
FALSE	

8) The impedance of an electrical coil is the resistance of the material the coil is made from?

Impedance is the inductance and the resistance of the electrical coil

TRUE	
FALSE	✓

9) The force exerted on a current- carrying conductor that is lying at right-angles to a magnetic field can be found by applying Flemings' RIGHT-HAND rule?

The conductor is carrying current and so will produce a magnetic field around itself. The conductor field will be opposed by the magnetic-field the conductor is lying in, and the conductor will be ejected from the field; this is the motor principle represented by the **'left-hand rule'**. The right-hand rule applies to the generator principle.

TRUE	
FALSE	✓

10) The term 'electrical discharge' is normally describes the operating principle of the fluorescent lamp?

TRUE	✓
FALSE	

Now check your answers.

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WORDSEARCH – Electrical Test Instruments

(Covering Unit 304, Learning outcome 4 (Level 3 Diploma in electrical Installations (Buildings & Structures) C&G 2365-03 or EAL equivalent)

Try to find the following words that are all related to electrical test instruments.

Ohmmeter	Electrode	Measurement
Resistance	Earth	Scale
Tester	RCD	Digital
Accuracy	Rotation	Probe
Loop test	Thermographic	lead
Megohm	Voltage	Calibration

A	Q	U	C	T	I	O	P	N	G	S	V	M	V	T	R	E	A	S	D
F	**L**	**O**	**O**	**P**	**T**	**E**	**S**	**T**	X	B	G	T	I	U	J	H	K	F	D
S	C	**H**	Z	W	R	V	F	T	H	Y	J	K	I	O	P	F	B	S	G
R	V	**M**	J	A	F	E	C	T	F	Y	B	H	J	U	K	I	G	C	C
V	N	**M**	**E**	**G**	**O**	**H**	**M**	Q	S	X	C	E	T	R	B	Y	N	U	M
B	H	**E**	**L**	**E**	**C**	**T**	**R**	**O**	**D**	**E**	E	F	V	C	G	H	N	B	T
N	Y	**T**	**H**	**E**	**R**	**M**	**O**	**G**	**R**	**A**	**P**	**H**	**I**	**C**	J	Y	U	I	K
H	T	**E**	X	K	R	T	U	N	H	D	F	G	H	T	R	W	Q	A	S
C	H	**R**	**E**	**S**	**I**	**S**	**T**	**A**	**N**	**C**	**E**	K	N	M	H	Y	J	U	B
Y	U	A	F	W	E	X	**E**	G	H	Y	**A**	J	K	I	O	**D**	**V**	W	S
I	I	D	V	A	Q	S	**S**	R	E	H	**R**	**O**	**T**	**A**	**T**	**I**	**O**	**N**	E
O	O	W	E	P	L	B	**T**	R	F	V	**T**	F	H	T	Y	**G**	**L**	P	T
M	S,	Q	R	R	**R**	O	**E**	U	I	P	**H**	W	E	G	N	**I**	**T**	Y	O
A	E	R	**A**	**C**	**C**	**U**	**R**	**A**	**C**	**Y**	Y	F	Q	O	P	**T**	**A**	X	G
TS	W	T	D	B	**D**	T	K	W	F	C	V	B	T	H	N	**A**	**G**	X	E
W	S	B	S	C	H	E	**P**	U	R	E	D	C	**S**	**C**	**A**	**L**	**E**	E	G
R	D	**M**	**E**	**A**	**S**	**U**	**R**	**E**	**M**	**E**	**N**	**T**	H	J	Y	J	K	U	L
D	F	F	T	D	E	R	**O**	Q	R	E	C	V	B	T	Y	U	N	M	K
C	T	V	**C**	**A**	**L**	**I**	**B**	**R**	**A**	**T**	**I**	**O**	**N**	A	F	E	R	T	N
X	G	Z	L	X	P	**L**	**E**	**A**	**D**	Y	T	H	V	G	B	F	R	S	C