

Electrical Instrument readings

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

In the following exercise match each unit with its measured unit.

No.	Unit		Measured Unit
1	Current 2×10^{-6}	A	36μA
2	Voltage 400×10^3	B	250000Ω
3	Resistance 150×10^6	C	5kW
4	Current 36×10^{-6}	D	150MΩ
5	Resistance 250×10^3	E	2MW
6	Power 50×10^2	F	400kV
7	Power 2×10^6	G	2μA
8	Voltage 400×10^6	H	400kV

Solutions:**1 - G****5 - B****2 - F****6 - C**

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Matching Terms and meanings:

(Covering Outcome 7 'Special Locations'; 'Understanding the practices and procedures for the preparation and installation of wiring systems and electro-technical equipment in buildings, structures and the environment' Unit 605 NVQ Level 3 Diploma 2357 – 13 and EAL equivalent)

The following terms can be found in BS7671:2008 +A3 2015, however the exact wording of the definition may not be as found in the Standard. Try to identify the correct definition for the terms stated below.

	Term		Definition
1	Distributor	A	A location intended for the diagnosis, treatment monitoring and care of patients.
2	Caravan	B	Assembly of photovoltaic arrays
3	Street furniture	C	An electrical system for electrical equipment provided to protect or warn persons in the event of a hazard, or essential to their evacuation from a location.
4	PV generator	D	Person/s responsible for the distribution of electrical energy to the customer
5	Safety service	E	An operation intended to remove, as quickly as possible, danger.
6	Emergency switching	F	Area where one or more stands, amusement devices or booths are erected for leisure use
7	Fair ground	G	Fixed equipment located on a highway.
8	Medical location	H	A trailer leisure accommodation vehicle ...

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Solution:

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

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Fault Diagnosis & Rectification

(Covering Outcome 3 'Understand how to complete the preparatory work prior to fault diagnosis and correction work' Unit 608 NVQ Level 3 Diploma 2357 – 13 and EAL equivalent)

No.	Question.	Answer
1	Which of the following combinations is the correct sequence of events when carrying out safe isolation? 1 reprove test instrument 2 isolate supply and lock off 3 prove isolation with test instrument 4 test instrument on known supply	
a	1,3,4,2	
b	4,2,3,1	X
c	1,4,3,2	
d	1,2,3,4	

No.	Question.	Answer

2	A fluorescent tube flashes on and off repeatedly and fails to light correctly. The fault is likely to be?	
a	The wrong wattage tube was fitted	
b	The tube is old and needs replacing	
c	There is a wiring fault to one of the tube connections	
d	The starter has failed and needs replacing	X

No.	Question.	Answer
3	Following decoration work in the hall and landing of a domestic house the two-way operated landing light no longer works correctly, the fault is going to be?	
a	The switch has been removed and not refitted correctly	X
b	The light fittings were removed and not reconnected	
c	The hall light was removed and reconnected wrongly	
d	The landing light has failed	

No.	Question.	Answer
4	When the supply is connected to a capacitor – start, single-phase electric motor it fails to start and produces a continuous humming sound. The most likely fault is?	
a	A loose neutral connection to the motor	
b	An open - circuit run winding	
c	A blown fuse	
d	An open – circuit start winding	X

No.	Question.	Answer
5	When carrying out continuity checks on the windings of a single-phase, capacitor - start electric motor, which of the following is most likely to be found?	
A	Start winding will have a lower resistance than the run winding	
b	Auxiliary winding will have a lower resistance than the main winding	
c	Start winding will have a higher resistance than the run winding	X
d	Run winding will have a higher resistance than the starting capacitor	

No.	Question.	Answer
6	A domestic customer reports that an outside PIR security light fails to operate. The lamp has been replaced with no effect. Which one of the following is NOT likely to be the cause?	
a	The protective device for the circuit has operated	
b	The PIR has developed a fault	
c	Both the old and new lamps are broken	X
d	There is a broken connection at the security lamp or PIR	

No.	Question.	Answer
7	Which one of the following senses is usually not required when carrying out fault finding?	
a	Hearing	
b	Seeing	

c	Touching	
d	Tasting	X

No.	Question.	Answer
8	Which one of the following statements is TRUE?	
a	A neutral conductor is connected to the centre pin of an Edison Screw lamp-holder	
b	When viewed from the front the line output of a BS1363 socket – outlet is on the left	
c	The BS EN 60309-2 plug used on 400V ac supplies is coloured red.	X
d	A solar photovoltaic array can be connected directly into a domestic consumer unit	

No.	Question.	Answer
9	A domestic central heating system fails to operate following an Electrical Installation Condition Report being undertaken on the property. What is the most likely cause of this failure?	
a	The heating system needs to be overhauled	
b	The electronic control panel has been damaged due to insulation resistance test voltages being applied	
c	The power supply has been isolated at the fused-connection unit for insulation tests to be made.	X
d	There is an closed circuit on the phase conductor	

No.	Question.	Answer

10	A fluorescent tube glows at each end but fails to start. The cause of this fault is most likely to be?	
a	Failure of the choke	
b	The tube has come to the end of its life	X
c	Incorrect tube has been fitted	
d	Failure of the starter	

No.	Question.	Answer
11	A customer reports that hot water is pouring from an overflow pipe when the immersion heater has been switched on for half an hour. The probable cause of this fault is?	
a	The immersion heater has failed	
b	The thermostat has failed and is permanently closed	X
c	Insufficient hot water is being used by the customer	
d	Water pressure has increased in the supply mains	

No.	Question.	Answer
12	A customer reports that a dimmer switch fails to dim a new lamp that replaces a broken 60W lamp. They notice that if the dimmer is operated from full-on the lamp dims slightly then goes out. What is the most likely reason is?	
a	The wiring has become disconnected at the ceiling rose	
b	The dimmer switch has developed a fault	
c	The replacement lamp is a low-energy compact fluorescent type	X
d	The new lamp is the wrong voltage	

No.	Question.	Answer
13	On inspection it is found the main neutral connection at a distribution board is discoloured and the insulation has bubbled. The most probable cause of this condition is?	
a	A loose neutral connection	X
b	Prolonged overcurrent	
c	Too many loads connected to the distribution board	
d	A short-circuit fault on one of the final circuits	

No.	Question.	Answer
14	Which of the following must be issued following the replacement of a damaged final circuit cable?	
a	Installation Certificate	
b	Minor Electrical Installation Works Certificate	X
c	Permit – to - Work	
d	Electrical Installation Condition Report	

No	Question	
15	Damage can be caused to electronic components in a circuit due to which of the following?	
a	Under-voltage caused by voltage drop in a circuit	
b	Over-voltage resulting from a lightning strike	X
c	Over-current due to a line – earth fault	
d	Frequent switching on-off of the equipment	

No.	Question.	Answer
16	A three-phase and neutral power supply must be isolated in order to carry out a repair on an industrial machine. Which of the following procedures must be carried out after permission is given to isolate the supply?	
a	Locate the machine to be repaired	
b	Safe isolation of the supply to the machine	X
c	Safe isolation of the supply to the building	
d	Removal of the supply cable to the machine	

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Initial verification of electrical installations: Answers

(Covering Unit 607 'Understand principles, practices and legislation for the inspection, testing commissioning and certification of electro-technical systems and equipment in buildings, structures and the environment' (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 and the EAL equivalent)

Task 1: complete the following questions regarding the principles, practices and legislation for the initial verification of electrical installations.

Reference (GN) is for the IET Guidance Note 3 document

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

Answer: *during construction and on completion of the installation (page15 GN3)*

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

Answer: *design and construction (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: *It would not be possible for an inspector to confirm the correct size cable has been installed throughout its length due to the cable being buried or enclosed within the fabric of the building. However he/she may 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 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 are kept for the lifetime of the installation. (page16 GN3)*

6) Briefly explain the meaning of the term 'Relevant criteria' in respect to the initial verification process.

Answer: *The designer may have made specific requirements for a given installation; as such the inspector will need to ask for these requirements or, if relevant, forward a copy of the test results to the designer for verification. (page16 GN3)*

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

Answer: *The person responsible for inspecting and testing the installation. (page16 GN3)*

8) State the correct titles of three certificates that apply to a new installation or additions to an existing installation.

Answer:

Electrical Installation Certificate – multiple-signature

Electrical Installation Certificate – single-signature

9) List three items of required information regarding the assessment of general characteristics for an installation.

Answer:

- *Maximum demand*
 - *Number and type of live conductors*
 - *Type of earthing*
 - *Nominal voltage*
 - *Supply frequency*
 - *Prospective short-circuit current*
 - *Earth loop impedance Z_e*
 - *Type and rating of overcurrent protective devices*
- See page 17 of GN3*

10) The Health and safety at Work etc... Act 1974 requires relevant information to be available for what purpose?

Answer: *safe use / inspection & testing / maintenance (page 17 GN3)*

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WORDSEARCH – Inspection and Testing

Try to find the following words that are all related to the inspection and testing process.
(Answers can be across, up, down or diagonal)

Visual	Meter	Insulation	Loop
Electrode	Protective	Main	Fault
Phase	Rotation	Earthing	Test
Bonding	Label	Inspection	Certificate
Probe	Safety	Disconnection	Prove

Note: one word is repeated, which one is it?

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

Answer: the repeated word is: **Fault**

Home Automation

(Covering Outcome 4 of Unit 605 (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 or EAL equivalent))

No.	Question.	Answer
1	Which of the following can be classed as a simple form of home automation?	
a	A 1-way light and dimmer switch	
b	A central heating timer / controller	X
c	A cooker control panel	
d	A ring final circuit	

No.	Question.	Answer
2	The most appropriate time to install home automation is?	
a	After the basic circuits have been installed	
b	Following commissioning of the basic circuits	
c	During the first re-inspection of the installation	
d	During construction of the installation	X

No.	Question.	Answer
3	A lighting system that operates when a person enters a room uses which of the following devices in order to operate?	
a	A sensor	X
b	An actuator	

c	A heat detector	
d	A passive switch	

No.	Question.	Answer
4	Which one of the following is not a wireless component?	
a	WiFi	
b	Bluetooth	
c	ZigBee	
d	Coaxial	X

No.	Question.	Answer
5	Home lighting can be controlled automatically by the following methods except?	
A	Light sensor	
b	Timer	
c	Double-pole switch	X
d	Smart phone App.	

No.	Question.	Answer
6	Which one of the following is not suitable for home automation?	
a	Security system	
b	Opening / closing of window blinds	
c	Heating and air conditioning	
d	Walking and caring for pets	X

No.	Question.	Answer
7	A Smart meter can be installed to provide data concerning which one of the following supply systems?	
a	Electricity	X
b	Oil	
c	Coal	
d	Woodchip	

No.	Question.	Answer
8	A Smart meter can provide accurate information for?	
a	The consumer only	
b	The service supplier only	
c	Both consumer and supplier	X
d	The local authority	

No.	Question.	Answer
9	In the context of Smart meter installations the abbreviation HAN refers to?	
a	RF signals	
b	Home area network	X
c	Home automation network	
d	Home automatic network	

No.	Question.	Answer
10	A device provided by an energy supplier for customer monitoring of their energy consumption is commonly known as a?	
a	Customer Monitoring Unit (CMU)	
b	Customer Electricity Monitor (CEM)	
c	Customer Data Recorder (CDR)	X
d	Customer Access Device (CAD)	

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Electrical measuring instruments:

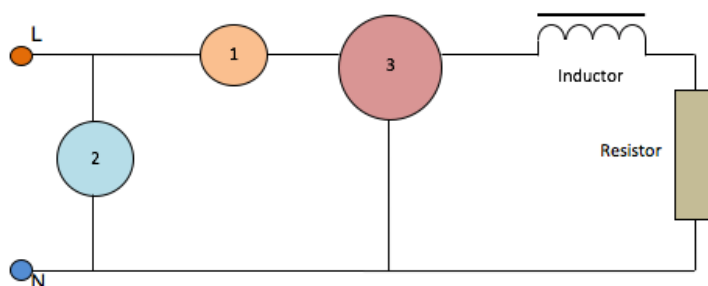
(Covering Unit 609 Outcome 7 'Understand how different electrical properties can affect electrical circuits, systems and equipment'. (Level 3 NVQ Diploma in Installing Electro-Technical Systems and Equipment 2357-13 / 91 and EAL equivalent)

Understanding the type and use of various electrical test instruments is important because incorrect connection can seriously damage the instrument, the circuit in which it is connected and could pose a danger to the operator.

Task 1:

The following 3 tasks relate to the measuring or determination of power in single-phase a.c. circuits.

Identify the correct name for each of the numbered components shown in the single-phase circuit diagram below:



Answer:

1 – Ammeter 2 – Voltmeter 3 – Wattmeter

Task 2:

State the reason for measuring the electrical quantities at the points shown in (1), (2) and (3), in the circuit shown above:

By obtaining measurements for current (1), voltage (2) and power (3) in the inductive circuit the power factor (pf) of the circuit can be calculated, the formula is:

$$\text{pf} = \frac{\text{W}}{\text{VA}} \quad \text{or} \quad \text{pf} = \frac{\text{true power}}{\text{apparent power}}$$

Task 3:


Calculate the power rating (W) of an inductive load if the power factor is 0.8 the current is 60A and the voltage is 230V.

$$\text{pf} = \frac{\text{true power}}{\text{apparent power}} \quad \text{pf} = \frac{\text{W}}{\text{VA}} \quad \text{therefore } \text{W} = \text{pf} \times \text{V} \times \text{A}$$

$$\text{W} = 0.8 \times 230 \times 60$$


$$\text{W} = \underline{11040 \text{ watts or } 11.04\text{kW}}$$

Task 4:

Electrical measuring instruments with the symbol:  shown on the scale means that the instrument has a?

Moving coil and is only suitable for connection into a d.c. circuit

Task 5:

Electrical measuring instruments with the symbol:  shown on the scale means that the instrument is a?

Moving iron type and is suitable for connection into a.c. or d.c. circuits

Task 6:

The most practical method of measuring current in a 'live' a.c. circuit cable is to use which type of instrument?

A clamp-on ammeter, sometime called a 'tong-tester'

Task 7:

The instrument used in Task 6 operates on which basic magnetic principle?

The principle of electro-magnetic induction

Task 8:

The light level produced by a newly installed lighting system in a commercial location must be measured. (a) What type of instrument is to be used for this measurement? (b) What is the unit of light measurement?

- (a) A 'photometer' or 'light-meter'
- (b) The unit of light measured by the photometer is **Lux** symbol (Lx)

Task 9:

Analogue instruments have a number of specific features, name **three** typical features.

- (i) Calibrated **scale** in fine divisions, bands or groups
- (ii) **Pointer** that moves across the scale when measurements are being made
- (iii) **Letter symbol** showing the unit that can be measured, for example **A** for amperes

Task 10:

What action needs to be taken to ensure electrical test instruments remain accurate throughout their lifetime?

The instrument/s should be 'calibrated' on a regular basis. Calibration may be required annually or at a time when the instrument is considered to be out of calibration, maybe following a trauma such as being dropped.