

This **examination consists** of two sections.

Section A - Twenty short answer questions worth three marks each. Candidates must answer **ALL TWENTY** questions. It is recommended that candidates allow approximately one *hour* for this section.

Section B—Six structured questions worth 15 marks each. Candidates must **answer ALL SIX** questions. It is recommended that **candidates** allow **approximately** 1¹/₂ hours for this section.

Section A - Answer ALL TWENTY questions in this section.

- 1 State the document that indicates the
 - a) statutory requirements for electrical systems (1 mark)
 - b) detailed inspection and testing requirements of BS 7671 (1 mark)
 - c) selection and use of electricians' test equipment (1 mark)

- 2 The owner of a small industrial unit requests an inspection and test for insurance purposes, Several circuits will be unavailable for testing. State
 - a) the main document to be completed (1 mark)
 - b) which part of this document will be of particular importance (1 mark)
 - c) who should be consulted regarding b) above (1 mark)

- 3 List the **three** documents that must be completed after the installation of a new cooker circuit. (3 marks)

- 4 State the **three** items of technical information that should be recorded on a minor works certificate, excluding test results. (3 marks)

- 5 Identify the form of contact defined by BS 7671 as
 - a) accidentally touching a live part (1 mark)
 - b) touching an extraneous conductive part made live due to a fault (1 mark)
 - c) touching the casing of a class I appliance made live due to a fault (1 mark)

- 6 State the units measured by **each** of the following instruments
 - a) low resistance ohmmeter (1 mark)
 - b) insulation resistance tester (1 mark)
 - c) RCD tester (1 mark)

- 7 A new radial socket outlet circuit has been installed. List, in sequence, the first three instrument tests to be carried out. (3 marks)
- 8 State the terms identifying the protective conductor connecting each of the following
- a) TNC-S (PME) supply terminal and the main earthing terminal (MET) (1 mark)
 - b) MET and the earth terminal of an immersion heater (1 mark)
 - c) *shaver* unit and copper pipes in a bathroom (1 mark)
- 9 State the IP code for an
- a) accessible top surface of an enclosure (1 mark)
 - b) intermediate barrier in a distribution board. (2 marks)
- 10 A continuity of c.p.c. test (utilising the phase conductor) is to be carried out on a lighting circuit. State the
- a) instrument to be used (1 mark)
 - b) action to be taken regarding the test leads (1 mark)
 - c) significance of the reading at the last point. (1 mark)
- 11 For a standard ring final circuit continuity test, state
- a) two reasons for conducting the test (2 marks)
 - b) the other dead test that is automatically conducted. (1 mark)
- 12 A twin cable has a phase to neutral insulation resistance value of 100 M Ω and an individual conductor resistance value of 0.8 Ω . Determine the values, if the cable
- a) was doubled in length (2 marks)
 - b) length was the *same* but the conductor cross-sectional area was halved. (1 mark)
- 13 For an insulation resistance test on a SELV circuit, state the
- a) instrument to be used (1 mark)
 - b) test voltage (1 mark)
 - c) minimum value of insulation resistance (1 mark)

- 14 An insulation resistance test between P N conductors on three individual single-phase circuits revealed the following values
0.00 M Ω ; 0.08 M Ω ; >200 M Ω
- What circuit conditions are indicated by these values? (3 marks)
- 15 For an earth fault loop impedance *test on a new circuit*, state
- a) why the 3/4 rule is applied (2 marks)
- b) if a measured value of 0.7 Ω is acceptable for the circuit maximum of 0.9 Ω . (1 mark)
- 16 State
- a) the purpose of conducting an earth fault loop impedance test (1 mark)
- b) one means of overcoming too high a value of Zs (1 mark)
- c) which of the s values measured at socket outlets on a ring final circuit should be recorded. (1 mark)
- 17 State three circumstances that would *require the* installation of a 30 mA RCD, (3 marks)
- 18 State the three tests to be carried out on a 500 mA RCD. (3 marks)
- 19 State three methods of determining a value for the prospective fault current at the origin of an installation. (3 marks)
- 20 For a TNC-S system, supplied at 230V, 50 Ha, state
- a) why PSCC and PEFC are *the same* (1 mark)
- b) the value of PFC if Ze was 0.01 (1 mark)
- c) the approximate value of PFC between phases if the single-phase value *was* 10 000A. (1 mark)

Section B Questions 21 to 26 refer to the following scenario. Answer ALL SIX questions. All questions carry equal marks.

The inspection and testing of a domestic premises is to be carried out after an existing consumers' control unit (c.c.u.), housing BS 3036 fuses, has been replaced and a cooker circuit added.

The new c.c.u. has a 100A main switch and circuits are now protected by a combination of circuit breakers and RCBOs. The existing installation is 25 years old and the wiring, together with the new circuit, comprises flat profile thermoplastic (p.v.c.) cable, clipped direct.

There is an isolator between the supply intake and the c.c.u. A periodic inspection and test was carried .. out five years previously, where all defects were rectified.

The supply and installation form a TN-S system with measured values of 0.3 Ω for Z_e , 0.8 kA for prospective earth fault current (PEFC) and 1.2 kA for prospective short circuit current (PSCC).

The schedule for the installation is attached (See Fig. 1).

- 21 a) List **all** the certification/documentation to be completed by the inspector. (4 marks)
- b) State who should retain the original copies listed in a). (1 mark)
- c) State where a copy of the attached installation schedule should be kept (1 mark)
- d) State which information regarding shock risk has not been recorded on the schedule. (2 marks)
- e) State which statutory and non-statutory documents would be relevant to the inspection and testing process. (4 marks)
- f) State the period of time recommended before the next inspection and test. (2 marks)
- g) Give one reason why an inspection and test may be required before the next due date. (1 mark)
- 22 a) State why the existing installation will need an inspection and test. (5 marks)
- b) List five items from the BS 7671 schedule of inspections relevant to the new cooker circuit. (5 marks)
- c) Identify a practical electrical problem commonly encountered when replacing the c.c.u. (2 marks)
- d) Explain how the installer could have overcome the problem in c). (3 marks)
- 23 a) i) List, in sequence, the tests required on the cooker circuit (4 marks)
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- ii) State the test instruments used and the measured units. (6 marks)
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- b) State the details that should be recorded on a schedule of test results regarding
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- i) the test instruments (2 marks)
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- ii) details of the supply (3 marks)

24 a) Describe how an insulation resistance test would be conducted on the whole installation. (8 marks)

b) Individual circuit test values are tabulated as shown below.

Circuit	1	2	3	4	5	6	7	8
MΩ	100	4	10	3	5	100	5	100

What would be the approximate overall value? (4 marks)

c) State if the value in b) is acceptable, giving reasons/comments (show **all** calculations). (3 marks)

25 a) Explain the particular importance of the earth fault loop impedance test on circuits of the existing installation now that the c.c.u. has been changed. (3 marks)

b) State

i) the conditions that need to be taken into account when comparing measured and maximum values of Z_s (2 marks)

ii) how this comparison is simply achieved. (1 mark)

c) Refer to the measured values, tabulated below.

Circuit	1	2	3	4	5	6	7	8
Measured Z_s	0.8	1.1	1.3	6.2	5.1	2	0.6	1.3

Calculate these values are acceptable. (3 marks)

d) Should any Z_s value given in c) not comply with BS 7671, state how this situation may be overcome. (2 marks)

e) State

i) why it may not be possible to conduct an earth fault loop impedance test on the lighting circuits (2 marks)

ii) how this problem may be resolved. (2 marks)

26 State

a) i) the reasons why circuits 2, 3 and 8 are protected by 30 mA RCBOs, and the others are not (5 marks)

ii) the test currents to be applied and the maximum operating times for these RCBOs (3 marks)

b) i) why there is a difference between the PEFC and PSCC (5 marks)

ii) which of these two values should be recorded on a schedule of test results. (2 marks)

T-NS 100A Main Switch

Circuit	Description	Points	Cable mm²	Cpc mm²	Type	Protection	Rating	Maz Zs Ω
1	Cooker	1	6.0	4	pvc	cb BS EN 60898-B	40A	1.2
2	S/O's Up	10	2.5	1.5	pvc	RCBO BS EN 61009	32A/30mA	1.5
3	S/O's Down	16	2.5	1.5	pvc	RCBO BS EN 61009	32A/30mA	1.5
4	Lights Up	6	1.0	1	pvc	cb BS EN 60898-B	6A	8
5	Lights Down	8	1.0	1	pvc	cb BS EN 60898-B	6A	8
6	Imm. Htr	1	1.5	1	pvc	cb BS EN 60898-B	16A	3
7	Shower	1	10.0	4	pvc	cb BS EN 60898-B	50A	0.96
8	Garage	1	4.0	2.5	SWA	RCBO BS EN 61009	32A/30mA	1.5

FIG 1