Section A -Answer ALL TWENTY questions. All questions carry equal marks. 4

1 State THREE circumstances that would require a periodic inspection and test to be carried out on an installation.

2 There are various documents that are relevant to the Inspection and Testing of an installation. State
a) one statutory item of documentation
b) two non-statutory items of documentation.

3 A Completion Certificate should be accompanied by signed documentation regarding three stages of an installation. Identify
a) TWO of these stages
b) the status of the person signing.

4 List THREE areas other than wear and tear and ageing that should be considered when carrying out a periodic inspection and test of an installation.

5 BS 7671 gives a list of 18 items to be checked, where relevant, during an initial inspection. List THREE of these.

6 State the electrical units in which EACH of the following test results would be expressed.
a) Insulation resistance.
b) External loop impedance.
c) Tripping time of an r.c.d.

7 Identify the type of circuit that would require the following applied voltages when conducting an insulation resistance test.
a) 250 Vdc
b) 500Vdc
c) 1000Vdc

8 List the first three tests that should be carried out during a ***periodic*** inspection and test of an installation

9 Name the protective conductors that connect together the following.
a) An electrically heated towel rail and exposed metal pipework in a bathroom.
b) The earthing terminal of a socket outlet and the main earthing terminal.
c) Main Gas and Water services to the main earthing terminal.

10 State the
a) essential action to be taken before disconnecting a main equipotential bonding conductor for test purposes during a periodic inspection and test
b) dangers that would arise if this action is not taken.

11 State the
a) instrument required to conduct a ring final circuit continuity test
b) other test that is automatically completed when the test in a) is carried out
c) significance of the reading obtained between P and c.p.c. at each socket outlet.

12 State the effect on
a) conductor resistance when conductor length increases
b) insulation resistance when cable length increases
c) conductor resistance when conductor c.s.a. increases.

13 List THREE actions to be taken apart from pre-test checks and precautions to enable an insulation resistance test to be carried out on an installation.

14 State the
a) test required to verify the electrical separation of a SELV circuit
b) instrument to be used
c) test voltage to be applied.

15 State the IP codes for enclosures that protect against a
a) jointed test finger and a 12.5 mm dia. sphere
b) jointed test finger only
c) 1 mm dia. wire.

16 With regards to polarity testing of an installation, state
a) the instrument to be used
b) in which conductor all single pole devices should be connected
c) to which part of an Edison screw lampholder the neutral conductor should be connected.

17 State the abbreviation for the system earthing arrangement associated with EACH of the following.
a) An overhead line supply without a protective conductor.
b) A multicore supply cable with separate neutral and earth conductors.
c) A supply cable in which the functions of earth and neutral are performed by one conductor.

18 State
a) two examples of special locations that require a reduction of protective device disconnection time from 0.4 s to 0.2 s
b) one example of a restrictive conductive location.

19 From the formula $Zs = Ze + \frac{(R1 + R2) \times 1.2 \times L}{1000}$, identify what is represented by

a) Zs
b) R1
c) L.

20 State the three relevant tests to be carried out on a 300 mA r.c.d.

21 State the

a) documentation and information it would be useful to have regarding this installation
b) action to be taken if such documentation is unavailable
c) documentation that will need to be completed for this inspection and test
d) test equipment needed.

22 a) State THREE general causes for concern regarding the use of this installation that would be revealed during a visual inspection.

b) Briefly explain the reasons for EACH of the concerns listed in a) and for each one suggest a possible solution.

23 a) Why is it necessary to carry out a ring final circuit continuity test in this garage installation?

b) i) Describe how the test in a) should be carried out.

ii) Indicate the instrument to be used.

iii) Which of the test results would be recorded on the test schedule?

24 a) State the

i) pre-test action that should be taken before conducting an insulation resistance test on this installation

ii) test voltage that would be used, and the minimum acceptable value of insulation resistance.

b) If each of the three circuits had been tested individually and gave readings of 80 M.Ω, 60 MΩ. and 30 MΩ respectively, calculate expected overall insulation resistance, showing all calculations.

25 The maximum tabulated values of earth fault loop impedance and the measured values for each of the circuits are as shown Fig 2

a) If the temperature at the time of test was 20° C (no factor) and the cable is 70° C p. v.c. (factor 1.2), determine by calculation whether the measured values are acceptable (Ze = 0.4.0.).

b) i) If correction factors were unavailable, which method would be used to make a valid comparison of measured and tabulated values?

ii) Using this method indicate whether the results would be acceptable. (Show all calculations.)

Fig 2

Circuit	Max.Tabulated Zs	Measured Zs
32A	1.07	0.83
10A	3.43	2.4
6A	5.71	4.4

26 The client informs you that the Regional Electricity Company is shortly to reinforce their network locally and change the existing supply to TN-C-S.

a) Explain the effect of such a change on earth fault impedance values and the rating of existing protective devices.

b) Draw a basic labelled diagram of the earth fault loop path for a TN-C-S earthing system.

Section B -Answer ALL SIX questions. All question carry equal marks.

All questions in Section B (21-26) refer to Fig. 1.

Fig. I shows the layout of the electrical installation in a detached garage. The owners have, for some time been using it for a business venture repairing lawnmowers (hand, electric and petrol driven). Heating is provided by two 2 kW convector heaters plugged in when needed. The three way metalclad consumer unit houses a double pole main switch and BS 3871 type 2 m.c.b.'s. All surface wiring is multi-core p. v.c./p. v.c. non-armoured cable clipped direct, and all socket outlets (these have been raised from their original position to bench level) and lighting switches are manufactured from moulded plastic. A ***periodic*** inspection and test of this installation is to be carried out.

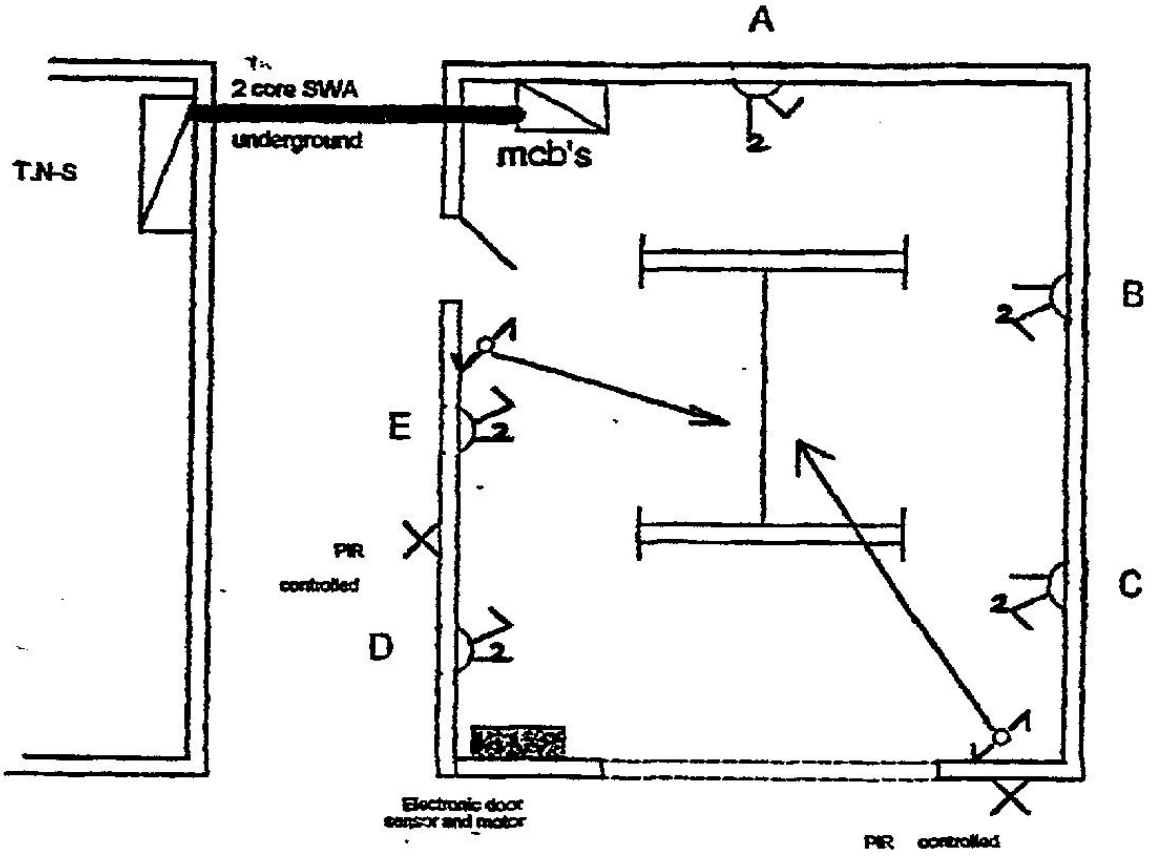

FIG. 1