

Complete, fold and seal
(see note 2 below)

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Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

64% ✓ many

1/a) $14 \times 40 = 560 \text{ m}^2$ ✓

$$N = \frac{E \times (\text{Metres})}{\text{lumens} \times \text{vf} \times \text{MF}} \quad \checkmark$$

$$N = \frac{370 \times 560}{16000 \times 0.8 \times 0.7} \quad \checkmark$$

$$N = 23.125 \quad \checkmark$$

$N = 24$ lamps required. ✓

(5)

b/

$$E = \frac{I}{d^2} \quad \checkmark$$

$$E = \frac{8000}{(8)^2} \quad \checkmark$$

$$E = 125 \text{ lux} \quad \checkmark$$

(3)

c). Location of luminaires.

X	X	X	X	X	X
X	X	X	X	X	X
X	X	X	X	X	X
X	X	X	X	X	X

(1)

Q1

9/10

2/ 8m long.

6 x 1.5 mm² Solid BS6004 PVC ✓

6 x 2.5 mm² " " " ✓

12 x 6 mm² BS7211 thermosetting stranded. ✓

12 x 10 mm² " " " ✓

$$6 \times 8.0 = 48. \quad \checkmark$$

$$6 \times 11.9 = 71.4 \quad \checkmark$$

$$12 \times 22.9 = 274.8. \quad \checkmark$$

$$12 \times 36.3 = \underline{435.6} \quad \checkmark$$

$$859.8.$$

(3)

∴ the required trunking is 100×25 (993 factor). ✓

$$b) 10 \text{ mm}^2 \text{ BS7211.} = \text{Factor} - 36.3. \checkmark$$

$$993 \div 36.3 = 27. \text{ } 10 \text{ mm}^2 \text{ cables could be installed.} \checkmark$$

(2)
Q2
5
5

3

- a) 150 A = Brown phase (I_a)
 200 A = Black phase (I_b)
 60 A = Grey phase (I_c).

$$I = \sqrt{(I_a^2 + I_b^2 + I_c^2) - (I_a \times I_b) - (I_b \times I_c) - (I_a \times I_c)}. \checkmark$$

$$I = \sqrt{(150^2 + 200^2 + 60^2) - (150 \times 200) - (200 \times 60) - (150 \times 60)} \checkmark$$

~~222~~

$$I_2 = \sqrt{(66100) - (30000) - (12000) - (9000)} \checkmark$$

$$I_2 = \sqrt{15100..} \checkmark$$

$$I_2 = 122.88 \text{ A.} \checkmark$$

(6)

Q3

6
10

b) X

c) X

4/

39A.

20m = distance.

70°C PVC single (ref method B).

With 2 x other circuits.

Ambient 34°C = Ca.

TN-S system = 0.8.

 $Z_e = 0.58 \Omega$.

$$I_b + I_n = 39A$$

✓ Design current correct.

$$I_z = \frac{I_n}{c_a \times c_g \times c_c \times c_f \times c_i}$$

$$I_z = \frac{39}{0.94 \times 0.65 \times 1 \times 1 \times 1} = 63.83A$$

Correct method used.

$$\text{Cable size} = 16 \text{ mm}^2$$

$$R_1 + R_2 = \frac{R_1 + R_2 \times 1.20 \times 1}{1000}$$

$$R_1 + R_2 = \frac{2.30 \times 1.20 \times 20}{1000}$$

$$R_1 + R_2 = 0.055 \Omega$$

$$0.055 \Omega = 0.06 \Omega$$

$$Z_s = Z_e + R_1 + R_2$$

$$Z_s = 0.58 + 0.06 = 0.64 \Omega$$

$$I_f = \frac{U_{oc}}{Z_s} = \frac{230V}{0.64 \Omega} = 359.38A$$

fault current.

Q4

8/15

$$S = \frac{I_f^2 \times t}{k} = \frac{(359.38)^2 \times 0.1}{115} = 0.988 \text{ mm}^2$$

$$S = 0.988 \text{ mm}^2$$

1 mm² CPC required.

$$S = \frac{I_f^2 \times t}{k}$$

$$S = \frac{I_f^2 \times t}{k}$$

$$S = \frac{(359.38)^2 \times 0.1}{115}$$

$$S = 0.98 \text{ mm}^2$$

Correct method used.

∴ 1 mm² CPC is required.

5/a).

$$R_1 + R_2 = \frac{(R_1 + R_2) \times \text{multiplier} \times L}{1000}$$

$$Z_e = 0.35 \Omega$$

Correct method used.

$$R_1 + R_2 = \frac{3.66 \times 1.20 \times 30}{1000}$$

$$R_1 + R_2 = 0.13 \Omega$$

$$Z_s = Z_e + R_1 + R_2 \quad Z_s = 0.35 \Omega + 0.13 \Omega \quad Z_s = 0.48 \Omega$$

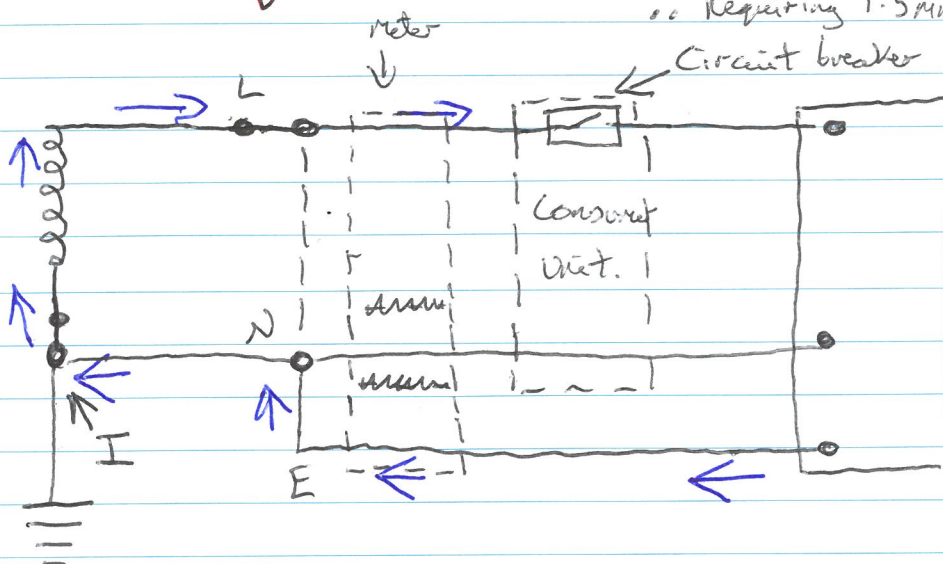
$$I_f = \frac{U_{oc}}{Z_s} \quad I_f = \frac{230}{0.48} \quad I_f = 479.2 \text{ A}$$

(2)

$$S = \frac{\sqrt{I^2 \times t}}{k} \quad S = \frac{\sqrt{(479.2)^2 \times 0.1}}{115} \quad S = 1.32 \text{ mm}^2$$

Requiring 1.5 mm² CPC.

b).



TN-C-S system

Fault path = →

The fault current path:

When the fault occurs with equipment/device it will complete a loop back to power source + to consumer unit, where the circuit breaker will activate. This also reduces any risk of further damage.

(2)

Q5

4/10