
2023 HSC Electrotechnology Marking Guidelines

Section I

Multiple-choice Answer Key

Question	Answer
1	D
2	B
3	D
4	D
5	C
6	A
7	C
8	B
9	A
10	B
11	B
12	D
13	A
14	C
15	B & C

Section II

Question 16 (a)

Criteria	Marks
• Identifies the required PPE when using an angle grinder	2
• Provides some relevant information	1

Sample answer:

Eye protection, hearing protection and gloves are required.

Question 16 (b)

Criteria	Marks
• Provides a sound comparison of the two given fixing methods	3
• Demonstrates some understanding of both of the two given fixing methods	2
• Provides some relevant information	1

Sample answer:

A nut and bolt is a non-permanent method that can be undone. It needs to be accessed from both sides to be tightened. Pop rivets are a permanent method of attachment. Only one side needs to be accessed and it has very little protrusion on the finished side.

Question 17

Criteria	Marks
• Shows relevant working in the correct calculation of the length of the required copper conductor	4
• Shows relevant working in the calculation of the resistance of the required copper conductor	3
• Makes progress towards calculating the resistance of a copper conductor	2
• Provides some relevant information	1

Sample answer:

$$R = \frac{\rho \ell}{A}$$

$$R_{1.5} = \frac{\rho \ell}{A} = 1.72 \times 10^{-8} \times \frac{50}{1.5} \times 10^{-6} = 0.57333 \Omega$$

$$R_4 = \frac{1}{2} R_{1.5} = \frac{1}{2} \times 0.57333 = 0.28667 \Omega$$

$$L_4 = \frac{R_4 \times A}{\rho} = \frac{0.28667 \times 4.0 \times 10^{-6}}{1.72 \times 10^{-8}} = 66.7 \text{ m}$$

Question 18 (a)

Criteria	Marks
<ul style="list-style-type: none"> Identifies a correct verbal method AND a correct non-verbal method of communication 	2
<ul style="list-style-type: none"> Identifies a correct verbal method OR a correct non-verbal method of communication 	1

Sample answer:

A verbal method of communication is having a toolbox talk and a non-verbal method of communication is sending an email.

Question 18 (b)

Criteria	Marks
<ul style="list-style-type: none"> Demonstrates a sound understanding of both short and long-term effects of excessive noise on a worker 	3
<ul style="list-style-type: none"> Demonstrates some understanding of short or long-term effects of excessive noise on a worker 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

In the short term, workers could have ringing in the ears or headaches. In the long term, workers could develop permanent hearing loss.

Question 19 (a)

Criteria	Marks
<ul style="list-style-type: none"> Outlines the benefits of using block diagrams to develop circuit diagrams 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

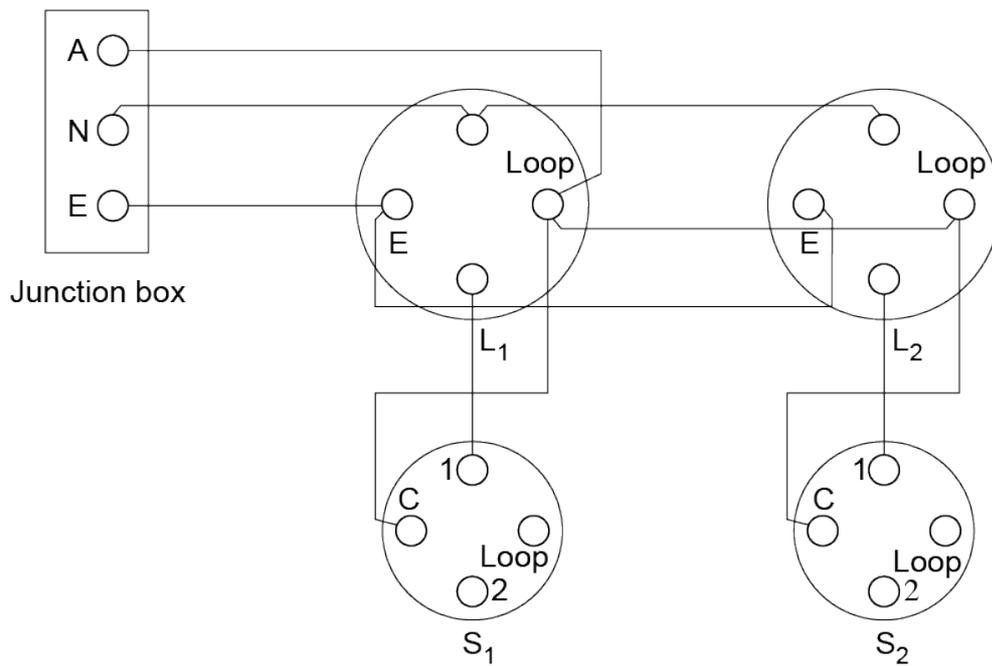
Sample answer:

A benefit of using block diagrams is that it allows for better planning of circuits. It also lowers the chance of creating errors in circuit diagrams.

Question 19 (b)

Criteria	Marks
<ul style="list-style-type: none"> Demonstrates a comprehensive understanding of converting the lighting circuit diagram into a correctly functioning wiring diagram 	5
<ul style="list-style-type: none"> Demonstrates a sound understanding of circuit and wiring diagrams creating a circuit with minor errors 	4
<ul style="list-style-type: none"> Demonstrates some understanding of circuit and wiring diagrams with some correct connections of wiring diagram 	3
<ul style="list-style-type: none"> Demonstrates a basic understanding of a wiring diagram with some correct connections 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:



Question 20 (a)

Criteria	Marks
• Determines the correct current flows	2
• Provides some relevant information	1

Sample answer:

$$I_1 = I_2 = I_{\text{total}} = 6 \text{ mA}$$

Question 20 (b)

Criteria	Marks
• Shows relevant working in the correct calculation of the resistance or provides a correct answer using correct unit	3
• Makes progress towards calculating the resistance	2
• Provides some relevant information	1

Sample answer:

$$R_T = \frac{V_{\text{total}}}{I_{\text{total}}} = \frac{50}{6 \times 10^{-3}} = 8.33 \times 10^3 \Omega$$

$$R_3 = R_T - R_1 - R_2 = 8.33 \times 10^3 - 2 \times 10^3 - 4.7 \times 10^3 \\ = 1.63 \times 10^3 \Omega$$

Question 20 (c)

Criteria	Marks
• Shows relevant working in the correct calculation of the voltage drop or provides a correct answer using correct units	3
• Makes progress towards calculating the voltage drop	2
• Provides some relevant information	1

Sample answer:

$$V_2 = I_2 \times R_2 = 4 \times 10^{-3} \times 4.7 \times 10^3 = 18.8 \text{ V}$$

Question 20 (d)

Criteria	Marks
• Shows relevant working in the correct calculation of power dissipated or provides a correct answer using correct units	3
• Makes progress towards calculating the power dissipated	2
• Provides some relevant information	1

Sample answer:

$$R_{\text{total}} = R_1 + R_2 + R_3 = 2 \times 10^3 + 4.7 \times 10^3 + 3 \times 10^3 = 9.7 \times 10^3 \Omega$$

$$P = I^2 R = (6 \times 10^{-3})^2 \times 9.7 \times 10^3 = 349.2 \times 10^{-3} \text{ W}$$

Question 20 (e)

Criteria	Marks
• Shows relevant working in the correct calculation of the current flow under short circuit condition or provides a correct answer using correct units	3
• Makes progress towards calculating the current flow under short circuit condition	2
• Provides some relevant information	1

Sample answer:

$$I_2 = I_{\text{total}} = \frac{V}{R_T} = \frac{V}{R_1 + R_2} = \frac{80}{2 \times 10^3 + 4.7 \times 10^3}$$

$$= 11.94 \times 10^{-3} \text{ A}$$

Section III

Question 21 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides a comprehensive description of how the sign should be installed, including the tools and materials required 	6
<ul style="list-style-type: none"> Provides a thorough description of how the sign should be installed, including the tools and materials required 	5
<ul style="list-style-type: none"> Provides a sound description of how the sign should be installed, including some tools and/or materials 	3–4
<ul style="list-style-type: none"> Provides some description of how the sign should be installed 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

10 mm diameter × 65 mm long dynabolts can be used to fix the sign to the wall. The sign would require 7 bolts, one in each corner approximately 50 mm from the edges and one in the middle of the sign near the bottom and two more evenly spaced at the top.

Tools needed:

- Battery rotary hammer drill with a 10 mm masonry bit
- Battery drill with a 10 mm wood bit
- Socket set
- Spirit level
- Tape measure
- Marker pen
- Hammer.

Method:

- Mark out the holes on the sign
- Drill the plywood with the wood bit
- Position the sign at correct height
- Use spirit level to ensure it is level
- Mark hole with marker pen
- Drill holes in brick wall with masonry bit
- Clean holes of any loose material
- Position sign and insert dynabolts through plywood into the holes
- Tap in with hammer
- Tighten bolts with socket
- Check level.

Question 21 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides a comprehensive description of the information in a Safe Work Method Statement from site preparation to commissioning of the LED sign 	8–9
<ul style="list-style-type: none"> Provides a thorough description of the information in a Safe Work Method Statement from the preparation of the site, to the installation and/or commissioning of the LED sign 	6–7
<ul style="list-style-type: none"> Provides a sound description of the information in a Safe Work Method Statement on fixing an LED sign to a wall 	4–5
<ul style="list-style-type: none"> Provides some description of the information in a Safe Work Method Statement 	2–3
<ul style="list-style-type: none"> Provides some relevant information 	1

Answers could include:

- Customer information
 - person’s name and contact details
- Site information
 - address
 - location of main switch board (MSB)
 - location amenities and first aid
 - worker on site
- Person conducting business
 - name and contact details
 - insurances
- Controls
 - traffic control and permits
 - work permit
- Workers/supervisors
 - on site
 - induction – specific and general
- Tools and Equipment
 - site safety
 - ◇ barriers
 - ◇ signage
 - ◇ temporary railing/fall arrest harness
 - tools – power and hand
 - PPE
 - fixing – fasteners
 - ladders/cherry picker
- Steps to complete tasks
 - site setup
 - mounting sign
 - wiring to electrical feed
 - testing
 - cleanup.

Section IV

Question 22

Criteria	Marks
<ul style="list-style-type: none"> Provides an extensive explanation of how electrotechnology businesses are addressing changes in technology while maintaining environmentally sustainable work practices Provides detailed reference to materials, processes and/or legislation Provides a logical, coherent and clear response using correct industry terminology and relevant workplace examples 	13–15
<ul style="list-style-type: none"> Provides a thorough explanation of how electrotechnology businesses are addressing changes in technology while maintaining environmentally sustainable work practices Provides reference to materials, processes and/or legislation Provides a logical and clear response using correct industry terminology and relevant workplace examples 	10–12
<ul style="list-style-type: none"> Demonstrates a sound understanding of changes in technology and sustainable work practices Provides some reference to materials, processes and/or legislation Provides a logical response using mostly correct industry terminology and/or relevant workplace examples 	7–9
<ul style="list-style-type: none"> Demonstrates some understanding of changes in technology and/or sustainable work practices Provides a response using some industry terminology and/or examples 	4–6
<ul style="list-style-type: none"> Demonstrates a limited understanding of technology and/or work practices 	1–3

Answers could include:

Changes in technology

Materials

- Waste products
 - recycling
 - reusing
 - repurpose
 - higher cost of copper wire promotes recycling
- New products
 - quick fix connectors
 - higher cost but save labor time and money
 - induction cooktops and heaters
 - effective but high energy usage
- Banning of materials
 - asbestos
 - replacement and disposal

Tools

- Battery powered tools
 - high outlay cost
 - battery cost higher and environmental issues with disposal.

Processes

- Computer usage/literacy increasing
 - ordering/invoicing
 - cost of new equipment
 - certificate of Compliance of Electric Work online completion
- Training
 - ongoing and updating – time and costs
 - ◇ eg solar, battery, working at heights
 - ◇ smart wiring courses
 - ◇ networking
 - ◇ telecommunications.

Legislation

- Maintain current training and knowledge
- AS3000 update and current.

2023 HSC Electrotechnology Mapping Grid

Section I

Question	Marks	HSC content – focus area
1	1	Components, tools and equipment – hand and power tools – pages 25–26
2	1	Components, tools and equipment – hand and power tools – page 25
3	1	Safety – safe work procedures and practices – page 37
4	1	Drawings, diagrams and compliance – architectural drawing – page 31
5	1	Sustainability – sustainable energy – pages 49–50
6	1	Drawings, diagrams and compliance - architectural drawings – page 31
7	1	Components, tools and equipment – fixing, securing and mounting accessories – page 26
8	1	Single path circuits – series circuits – page 43
9	1	Sustainability – compliance – page 50
10	1	Components, tools and equipment – hand and power tools – pages 25–26
11	1	Drawings, diagrams and compliance – electrical drawings and diagrams – page 32
12	1	Sustainability – energy sector workplace – page 51
13	1	Components, tools and equipment – hand and power tools – page 26
14	1	Single path circuits – series circuits – page 43
15	1	Single path circuits – Ohm's law – page 43

Section II

Question	Marks	HSC content – focus area
16 (a)	2	Components, tools and equipment – hand and power tools – page 25
16 (b)	3	Components, tools and equipment – fixing, securing and mounting accessories – page 27 Components, tools and equipment – joining components – page 28
17	4	Single path circuits – resistors – page 44
18 (a)	2	Working in the industry – working with others – page 57
18 (b)	3	Safety – risk management – page 37
19 (a)	2	Drawings, diagrams and compliance – electrical drawings and diagrams – page 32
19 (b)	5	Drawings, diagrams and compliance – electrical drawings and diagrams – page 32
20 (a)	2	Single path circuits – series circuit – page 43
20 (b)	3	Single path circuits – series circuit – page 43
20 (c)	3	Single path circuits – series circuit – page 43
20 (d)	3	Single path circuits – series circuit – page 43
20 (e)	3	Single path circuits – series circuit – page 43

Section III

Question	Marks	HSC content – focus area
21 (a)	6	Components, tools and equipment – hand and power tools – pages 26–27 Components, tools and equipment – fixing, securing and mounting accessories – pages 25–26 Working in the industry – work tasks and practices – pages 55–56
21 (b)	9	Safety – safe work procedures and practices – page 37 Working in the industry – work tasks and practices – pages 55–56

Section IV

Question	Marks	HSC content – focus area
22	15	Sustainability – environment – issues and sustainability – page 49 Sustainability – energy sector workplace – pages 50–51 Working in the industry – work tasks and practices – pages 56–57