2021 HSC Electrotechnology Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16 (a)

Criteria	Marks
• Names both part *A* and part *B* of the device correctly	2
• Names either part *A* or part *B* of the device correctly	1

Sample answer:

A = 10 amp socket outlets and switches.
B = circuit breaker protection/RCBO.

Question 16 (b)

Criteria	Marks
• Identifies correctly the safety checks that need to be done before each use	2
• Identifies a safety check that needs to be done before each use	1

Sample answer:

The unit should be checked to make sure that the lead has no cuts and the plug is properly fitted. It should also have a tag that has not expired. The circuit breaker function should also be tested by pushing the test button.

Question 17 (a)

Criteria	Marks
• Provides an outline of the function of the switch S_2	2
• Provides some relevant information	1

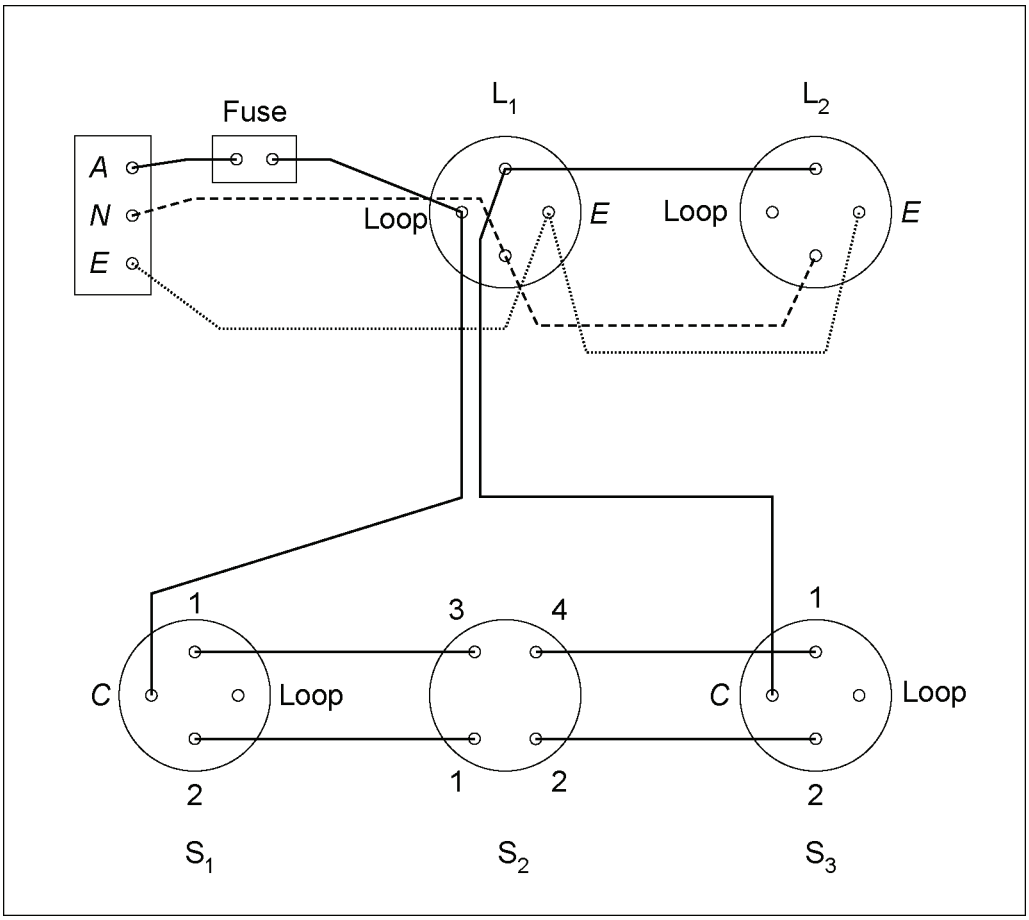
Sample answer:

The switch S_2 allows any of the three switches to turn the lights on or off independently.

Question 17 (b)

Criteria	Marks
• Demonstrates a comprehensive understanding of converting the lighting circuit diagram into a wiring diagram • Provides correct connections of wiring	5
• Demonstrates a sound understanding of a wiring diagram and correct connections of wiring • Provides most correct connections of wiring	3–4
• Demonstrates a basic understanding of a wiring diagram • Provides some correct connections of wiring	1–2

Sample answer:



Question 18 (a)

Criteria	Marks
• Demonstrates a sound understanding of the features required for a drill and drill bit that could perform the operation	2
• Provides some relevant information	1

Sample answer:

- Drill – the drill should have the capacity to drill through masonry with hammer function
- Drill bit – eg 270 mm with a tungsten carbide tip/masonry.

Question 18 (b)

Criteria	Marks
• Demonstrates a comprehensive understanding of the process for attaching a metal riser bracket that can hold 20 kg to the double brick wall	4
• Demonstrates a sound understanding of the process needed for attaching a metal riser bracket that can hold 20 kg to the double brick wall	3
• Demonstrates some understanding of the process needed for attaching a metal riser bracket that can hold 20 kg to the double brick wall	2
• Provides some relevant information	1

Sample answer:

The holes need to be marked out to make the bracket level and plumb. Make sure to use the appropriate personal protection equipment (PPE) such as eye and hearing protection. When dyna bolts are used, drill the holes to the same diameter as the bolt to the correct depth. Clean out the holes. Then insert the bolts through the bracket, remove the nuts and washer. Place the bracket and check for level. Tighten bolts with the required force.

Question 19 (a)

Criteria	Marks
• Demonstrates a sound understanding of the advantages of adding battery storage to the system	2
• Provides some relevant information	1

Sample answer:

Battery storage would allow the use of electricity when the panels are not generating. This would also provide emergency power if there was a blackout, moving to off grid possibilities.

Question 19 (b)

Criteria	Marks
• Demonstrates a comprehensive understanding of other methods the farm could use to reduce its carbon footprint	5
• Demonstrates a thorough understanding of other methods the farm could use to reduce its carbon footprint	4
• Demonstrates a sound understanding of other methods the farm could use to reduce its carbon footprint	3
• Demonstrates a basic understanding of other methods the farm could use to reduce its carbon footprint	1–2

Sample answer:

To reduce the carbon footprint, consumption of power and methods of production of power could be reviewed. Use energy-efficient lighting and appliances. Time clock sensors could be used to turn lighting on or off. Improving insulation aids in power use to heat or cool areas will improve efficiency.

To expand power generation, more solar panels or wind and methane generation could be considered. A variety of ways should be used to make it less reliant on one source, eg no wind means no power generation.

Question 20 (a)

Criteria	Marks
• Provides correct formula and correct substitution of values or provides a correct answer using correct units	2
• Provides correct formula and/or correct substitution of values with some errors or correct answer using incorrect units	1

Sample answer:

$$R_T = R_1 + \left(\left(R_3 + R_4 \right)^{-1} + R_2{}^{-1} \right)^{-1}$$

$$= 47 + \left((33 + 15)^{-1} + 56^{-1} \right)^{-1}$$

$$= 72.85\,\Omega$$

Question 20 (b)

Criteria	Marks
• Provides correct formulae and correct substitution of values or provides a correct answer using correct units	3
• Provides correct formulae and correct substitution of values with some errors or correct answer using incorrect units	2
• Provides correct formulae or correct substitution of values	1

Sample answer:

$$I_T = \frac{V}{R_T} = \frac{24}{72.85} = 0.32944\ A$$

$$V_1 = R_I I_T = 47 \times 0.32944 = 15.48368\ V$$

$$V_2 = V - V_1 = 24 - 15.48368\ V$$

$$= 8.51632\ V$$

$$I_2 = \frac{V_2}{R_2} = \frac{8.51632}{56} = 0.152077\ A$$

Question 20 (c)

Criteria	Marks
• Provides correct formulae and correct substitution of values or provides a correct answer using correct units	3
• Provides correct formulae and correct substitution of values with some errors or correct answer using incorrect units	2
• Provides correct formulae or correct substitution of values	1

Sample answer:

$$I_{3.4} = I_T - I_2 = 0.32944 - 0.152077\ A$$
$$= 0.177363\ A$$

$$V_3 = I_{3.4} R_3 = 0.177363 \times 33 = 5.852979\ V$$

Question 20 (d)

Criteria	Marks
• Provides correct formula and correct substitution of values or provides a correct answer using correct units	3
• Provides correct formula and correct substitution of values with some errors OR correct answer using incorrect units	2
• Provides correct formula or correct substitution of values	1

Sample answer:

$$P_4 = I_{3.4}{}^2 \times R_4 = 0.177363^2 \times 15 = 0.47186\,W$$

Section III

Question 21

Criteria	Marks
• Demonstrates a comprehensive understanding of how management and workers in the electrotechnology industry should prevent, respond to and manage workplace injuries • Provides a logical, coherent and clear response using correct industry terminology	13–15
• Demonstrates a thorough understanding of how management and workers in the electrotechnology industry should prevent, respond to and manage workplace injuries • Provides a logical and clear response using correct industry terminology	10–12
• Demonstrates a sound understanding of how management and workers in the electrotechnology industry should prevent, respond to and manage workplace injuries • Provides a logical response using correct industry terminology	7–9
• Demonstrates some understanding of how management and/or workers in the electrotechnology industry should prevent, respond to and/or manage workplace injuries • Provides a response using some correct industry terminology	4–6
• Provides some relevant information	1–3

Answers could include:

- Prevent
  - Policy and procedures
    - ◊ White card
    - ◊ Site induction
    - ◊ Specific inductions for working at height or confined spaces
  - Safe Work Method Statement (SWMS)
  - Materials Safety Data Sheets (MSDS)
  - Tagging of leads
  - The use of verbal and non-verbal communication techniques
  - Risk assessments
  - Work health and safety committee (WHS)
  - Safety officer on large sites
  - Regular inspections of site and equipment
  - Ladder safety checks
  - Work platforms
  - Working at height harness
  - Manual handling, eg lifting aids and gloves
  - Hearing loss prevention
  - UV protection
  - Good housekeeping practices eg inspections by management/health and safety officer, signage, safety tape etc

- Respond to
  - First Aid trained staff
  - First Aid kits
  - Location signage
  - Emergency response planning
  - Fire and evacuation plan implemented
  - Ring emergency number 000
  - Near miss register
  - Distinguish between manageable first aid and emergency situation
  - Safe removal of an electric shock victim from live power
  - DRSABCD (danger, response, send for help, airway, breathing, CPR, defibrillator)
- Manage
  - WHS committee review of incidents and amend policy and plans
  - Implementing SafeWork NSW recommendations
  - Return to work program for injured workers
  - Awareness of legal and ethical responsibilities that may impact on management care.

Section IV

Question 22 (a)

Criteria	Marks
• Provides a comprehensive explanation of each step required to de-energise and isolate the circuit at the switchboard • Provides a logical and coherent response using industry terminology	7
• Provides a thorough explanation of each step required to de-energise and isolate the circuit at the switchboard • Provides a logical and coherent response using industry terminology	5–6
• Provides a sound explanation of how to de-energise and isolate the circuit at the switchboard • Provides a response using some industry terminology	3–4
• Provides some relevant information on how to de-energise and/or isolate the circuit at the switchboard	1–2

Answers could include:

- Inspect the switchboard and identify the protection of the circuit, eg residual current operated circuit breaker with over current protection (RCBO) because it is necessary to identify which circuit needs de-energising to make the circuit safe.
- Notify the person affected and inform them of the need for isolation and lockout as people in the area need to be aware that the power will be turned off.
- Test the test equipment (test lamp or voltmeter) on a known source to ensure the test equipment is working.
- Test the circuit to verify if the circuit is dead or live for personal safety.
- Isolate and de-energise the circuit, eg turn off the circuit breaker or remove high rupturing capacity (HRC) fuse to de-energise the circuit.
- Lock out by using a lockable device and padlock with a tag attached with the contact information of person performing the lockout and estimate the time to re-energise the circuit. This isolates the circuit from the supply and stops people from turning the power back on.
- Re-test the circuit to confirm the circuit is de-energised.
- Test the test equipment again (test lamp or voltmeter) on a known source because this will ensure the test equipment did not fail during the test.

Question 22 (b)

Criteria	Marks
• Demonstrates a comprehensive understanding of the most appropriate fault-finding methods to determine the type of fault causing the power circuit to trip • Provides a logical response using correct terminology	8
• Demonstrates a thorough understanding of the most appropriate fault-finding methods to determine the type of fault causing the power circuit to trip • Provides a logical response using correct terminology	6–7
• Demonstrates a sound understanding of the most appropriate fault-finding methods to determine the type of fault causing the power circuit to trip • Provides a response using industry terminology	4–5
• Demonstrates a basic understanding of the most appropriate fault-finding methods to determine the type of fault causing the power circuit to trip • Provides a response using some industry terminology	2–3
• Provides some relevant information	1

Answers could include:

The process of fault-finding needs to be logical and sequential. This is more time efficient and gives a better chance of finding the fault.

Visual inspection

- Check the leads for cuts or signs of damage that could be physical damage to the cable caused by rodent, heat exposure or construction damage.
- Check for any physical damage of the appliance caused by misuse or wear and tear.
- Use an earth leakage detector to check for earth leakage from damage to insulation or loose connections.

Insulation resistance

- Use an insulation resistance tester. This is used to test and record insulation resistance of the appliance, eg this could have been caused by physical damage, overheating of the cable.

Substitution

- Replace switchboard components and retest the circuit. This may be done by loading the circuit by turning on appliances. This could be caused by faulty circuit breaker or fuse.

Short circuit test

- Use an ohmmeter to test the resistance between active and neutral to find if there is a short circuit in the appliance or very low resistance in the live conductors.

2021 HSC Electrotechnology Mapping Grid

Section I

Question	Marks	HSC content – focus area	Employability skills (Please put an X where appropriate)							
			Communication	Teamwork	Problem–solving	Initiative and enterprise	Planning and organising	Self–management	Learning	Technology
1	1	Components, tools and equipment — fixing, securing and mounting accessories – page 31								X
2	1	Work in the industry — energy sector worker – pages 67–69								X
3	1	Safety — safe work practices and procedures – page 55							X	
4	1	Safety — risk management – pages 54–55	X							
5	1	Sustainability — energy sector workplace – pages 61–62		X						
6	1	Drawings, diagrams and compliance — pages 48–49					X			
7	1	Drawings, diagrams and compliance – pages 48–49					X			
8	1	Components, tools and equipment– hand and power tools – pages 30–31								X
9	1	Sustainability — energy sector workplace – pages 60–61				X				
10	1	Direct current circuits — problem solving – pages 44–45			X					
11	1	Direct current circuits — parallel circuits – page 40			X				X	
12	1	Components, tools and equipment — joining components – page 33					X			
13	1	Direct current circuits — resistors – page 41	X		X					
14	1	Direct current circuits — energy and power – page 38			X				X	

Question	Marks	HSC content – focus area	Employability skills (Please put an X where appropriate)							
			Communica-tion	Teamwork	Problem–solving	Initiative and enterprise	Planning and organising	Self–management	Learning	Technology
15	1	Direct current circuits — capacitance – pages 43–44			X				X	

Section II

Question	Marks	Unit of competency / Element of competency	Employability skills (Please put an X where appropriate)							
			Communica-tion	Teamwork	Problem–solving	Initiative and enterprise	Planning and organising	Self–management	Learning	Technology
16 (a)	2	Components, tools and equipment — hand and power tools – page 30								X
16 (b)	2	Components, tools and equipment — hand and power tools – page 30					X			
17 (a)	2	Drawings, diagrams and compliance — electrical drawings and diagrams – pages 48–49			X					
17 (b)	5	Drawings, diagrams and compliance — electrical drawings and diagrams – pages 48–49	X		X					
18 (a)	2	Components, tools and equipment — hand and power tools – pages 30–31								X
18 (b)	4	Components, tools and equipment — fixing, securing and mounting accessories – pages 31–32					X			
19 (a)	2	Sustainability — energy sector workplace – page 61				X				
19 (b)	5	Sustainability — environment – issues and sustainability – page 60 Sustainability — sustainable energy – pages 60–61 Sustainability — energy sector workplace – pages 61–62				X		X		
20 (a)	2	Direct current circuits — series/parallel circuits – page 40			X				X	

Question	Marks	Unit of competency / Element of competency	Employability skills (Please put an X where appropriate)							
			Communica-tion	Teamwork	Problem–solving	Initiative and enterprise	Planning and organising	Self–management	Learning	Technology
20 (b)	3	Direct current circuits — series/parallel circuits – page 40			X				X	
20 (c)	3	Direct current circuits — series/parallel circuits – page 40			X				X	
20 (d)	3	Direct current circuits — energy and power – page 38			X				X	

Section III

Question	Marks	Unit of competency / Element of competency	Employability skills (Please put an X where appropriate)							
			Communica-tion	Teamwork	Problem–solving	Initiative and enterprise	Planning and organising	Self–management	Learning	Technology
21	15	Safety — incidents, accidents and emergencies – page 56–57 Safety — safe work practices and procedures – page 55–56 Safety — WHS compliance – page 53–54	X				X			

Section IV

Question	Marks	Unit of competency / Element of competency	Employability skills (Please put an X where appropriate)							
			Communica-tion	Teamwork	Problem–solving	Initiative and enterprise	Planning and organising	Self–management	Learning	Technology
22 (a)	7	Work in the industry — energy sector worker – page 67–69					X	X		
22 (b)	8	Work in the industry — energy sector worker – page 67–69			X		X			