2020 HSC Electrotechnology Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16 (a)

Criteria	Marks
• Identifies THREE steps the worker must take in the drilling process to drill the hole neatly and effectively	2
• Provides some relevant information	1

Sample answer:

Material is clamped in a vice securely, the mark for drilling is centre-punched and the hole is pilot drilled.

Answers could include:

The correct pedestal drill speed should be selected.

Question 16 (b)

Criteria	Marks
• Provides an extensive description of the precautions and PPE that must be considered to complete the task successfully • Uses correct industry terminology	4
• Provides a sound description of the precautions and PPE that must be considered to complete the task successfully • Uses industry terminology	2–3
• Provides a basic description of the precautions and PPE that must be considered to complete the task successfully • Uses non industry specific terminology	1

Sample answer:

The ladder needs to be locked open, and placed securely on all feet. Pedestrian traffic needs to be diverted. PPE must be worn, which includes eye, head, foot and dust suppression equipment. Drilling machine is serviceable and tagged. Drilling tool (bit/holesaw) is sharp and serviceable. Behind the ceiling has been checked for services and/or other obstruction.

Question 17

Criteria	Marks
• Demonstrates a sound understanding of how managers can improve productivity of workers in electrotechnology companies using teamwork	3
• Demonstrates some understanding of how managers can improve productivity of workers in electrotechnology companies using teamwork	2
• Provides some relevant information	1

Sample answer:

Managers can delegate team members to specific installation tasks by utilising their individual electrical knowledge and skills. Managers can also encourage team members to offer each other support, ideas and feedback, which can alleviate stress and improve work performance.

Question 18

Criteria	Marks
• Provides a comprehensive explanation of the advice a trained electrotechnology worker could give to household customers to increase the efficiency of their energy use and reduce their electricity bill • Uses correct industry terminology	6
• Provides a thorough explanation of the advice a trained electrotechnology worker could give to household customers to increase the efficiency of their energy use and reduce their electricity bill • Uses industry terminology	4–5
• Provides some explanation of the advice a trained electrotechnology worker could give to household customers to increase the efficiency of their energy use and reduce their electricity bill • Uses some industry terminology	2–3
• Provides some relevant information	1

Sample answer:

The electrotechnology worker could advise the household customers in strategies that directly minimise wastage of electricity, or increase the efficient use of electricity. Examples of this fall into several categories.

Household customers could be advised to undertake an energy audit, by starting with a review of the energy bill, switch to using LED lamps, purchase higher efficiency appliances, eg the use of inverter technology and move to off peak or solar hot water, to increase the efficiency of their energy use.

Household customers could also be advised to install PV solar and battery storage to save on their electricity bill in the longer term. They could also be advised that some electricity providers allow for smart switching and smart metering, where the load is controlled at the supplier level so that they can control the use of certain appliances. This often comes with very attractive financial benefits.

Answers could include:

Behaviourally, household customers could change the times of day when load is used, such as running dishwasher or pool pump at times of low energy demand so that the cost of the energy is minimised.

Question 19 (a)

Criteria	Marks
• Provides correct formulae AND correct substitution of values OR provides a correct answer using correct units	2
• Provides correct formulae OR correct substitution of values	1

Sample answer:

$P = VI \qquad R = \frac{V}{I}$

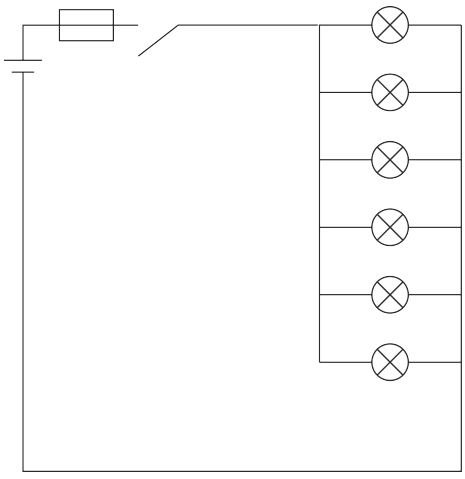
$I = \frac{P}{V} \qquad R = \frac{V^2}{P} = \frac{24 \times 24}{5} = 115.2\ \Omega$

Question 19 (b)

Criteria	Marks
• Demonstrates a comprehensive understanding of circuit components and their correct placement • Creates a functioning circuit with six lamps in correct working order • Correctly positions all components	4
• Demonstrates some understanding of circuit components and their placement • Creates a functioning circuit with six lamps in some correct working order • Correctly positions some components	2–3
• Demonstrates basic understanding of circuit components and their placement • Creates a non-functioning circuit	1

Sample answer:

Note: Candidates may provide an alternative arrangement for the LED lamps. However, the voltage and power value for the circuit must be provided.



Question 20 (a)

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:

$$R_T = [(R_1 + R_2)^{-1} + (R_3 + R_4)^{-1}]^{-1} = [(47 + 150)^{-1} + (120 + 72)^{-1}]^{-1} = 97.23\ \Omega$$

Question 20 (b)

Criteria	Marks
• Provides correct formulae AND correct substitution of values OR provides a correct answer using correct units	2
• Provides correct formulae OR correct substitution of values	1

Sample answer:

$$I_1 = \frac{V}{R_1 + R_2} = \frac{24}{47 + 150} = \frac{24}{197} = 0.122\ A$$

$$I_2 = \frac{V}{R_3 + R_4} = \frac{24}{120 + 72} = \frac{24}{192} = 0.125\ A$$

$$I_T = I_1 + I_2 = 0.122 + 0.125 = 0.247\ A$$

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:

$R_A = R_1 + R_2 = 47 + 150 = 197\ \Omega$

$I = V/R_A = 24/197 = 0.122\ A$

$V_2 = IR_2 = 0.122\ A \times 150 = 18.27\ V$

OR

$$V_2 = \frac{R_2}{R_1 + R_2} \times V_5 = \frac{150}{47 + 150} \times 24 = 18.27\ V$$

Question 20 (d)

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:

$$I = \frac{V}{R_3 + R_4} = \frac{24}{120 + 72} = \frac{24}{192} = 0.125 \text{ A}$$

$$P = I^2 R_3 = (0.125)^2 \times 120 = 1.875 \text{ W}$$

Question 20 (e)

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:

$$R_1 + R_2 = 47 + 150 = 197 \ \Omega$$

Section III

Question 21

Criteria	Marks
• Demonstrates an extensive understanding of the electrotechnology workplace policies and procedures that need to be in place to support electrical apprentices in fulfilling their roles and responsibilities • Provides a logical and clear response that shows extensive knowledge of the links between electrotechnology workplace policies and procedures and electrical apprentice roles and responsibilities • Uses correct industry terminology	13–15
• Demonstrates a thorough understanding of the electrotechnology workplace policies and procedures that need to be in place to support electrical apprentices in fulfilling their roles and responsibilities • Provides a logical and clear response that shows knowledge and understanding of the link between electrotechnology workplace policies and procedures and electrical apprentice roles and responsibilities • Uses correct industry terminology	10–12
• Demonstrates a sound understanding of the electrotechnology workplace policies and procedures that need to be in place to support electrical apprentices in fulfilling their roles and responsibilities • Provides a response that shows sound knowledge and understanding of the link between some electrotechnology workplace policies and procedures and electrical apprentice roles and responsibilities • Uses correct industry terminology	7–9
• Demonstrates some understanding of the electrotechnology workplace policies and procedures that need to be in place to support electrical apprentices in fulfilling their roles and responsibilities • Provides a response that shows some knowledge and understanding of the link between some electrotechnology workplace policies and procedures and electrical apprentice roles and responsibilities • Uses some correct industry terminology	4–6
• Demonstrates basic understanding of the electrotechnology workplace policies and procedures that need to be in place to support electrical apprentices in fulfilling their roles and responsibilities	1–3

Answers could include:

Workplace policies and procedures:

- Workplace health and safety policy
- Code of conduct of electrical apprentices
- Apprentices recruitment policy
- Mobile phone use at work policy
- Non-smoking policy
- Drug and alcohol policy
- Anti-discrimination and harassment policy.

Policy and Procedures of the Electrotechnology workplace are an integral part of the documentation that is required to meet statutory requirements. They prevent uncertainty about how particular situations are handled and support apprentices to understand their roles and responsibilities.

Having a documented procedure for making decisions will be cost effective, create positivity among apprentices and their supervisors and improve their job efficiency.

While policies may take time to develop, they provide a process that allows everyone to follow a series of steps to achieve the same result consistently.

Policies and procedures can create a safe workplace by making sure tasks are carried out safely and consistently every time. Each element of the system is integral in supporting each other as workplace incidents and accidents are usually the result of a chain of events.

Electrical apprentice roles and responsibilities:

- Interpreting work plan and schematics
- Updating work logs, client accounts
- Administrative duties
- Ordering replacement parts and equipment as needed
- Completing electrical installations and carrying out various maintenance duties
- Reporting any hazards or faults found with electrical equipment or fittings and 'lock out and tag out' faulty equipment to ensure others are aware of the fault immediately
- Notifying supervisor, using the WHS Incident Recording System, of any electrical hazard with potential to cause harm, or electrical incident which has caused harm.

Electrical apprentice daily activities may include:

- Installing, testing, repairing and maintaining electrical circuits and wiring systems and supports
- Diagnosing and testing wiring faults by using electronic testing equipment
- Installing electrical switchboards and earthing systems

Onsite learning may include:

- Using work instructions
- Schedule of work and work plan
- Job specifications
- Standard operating procedures
- Drawing/diagram/sketch
- Manufacturer manuals
- Australian Standards.

Offsite learning may include:

- Electrical Theory and Wiring Practices
- Attend training to establish competency in the use of plant and equipment particularly where competency testing or licensing is required.

Section IV

Question 22 (a)

Criteria	Marks
• Provides an comprehensive explanation of how the potential WHS issues involved in the project could be addressed • Uses industry terminology	6
• Provides a thorough explanation of how the potential WHS issues involved in the project could be addressed • Uses industry terminology	4–5
• Provides a sound explanation of how the potential WHS issues involved in the project could be addressed	2–3
• Provides some relevant information	1

Answers could include:

- Driveway and traffic control – traffic controllers (lollipop people), signage and traffic calming measures. Possible rerouting of the driveway around the other side of the Battery Shed to isolate the entire site
- Aerial cabling – height accessing machinery and expertise needed for task completion; subcontract task to specialists
- Underground cabling – trenching contractors and associated WHS issues. Water blasting or perpendicular subterranean tunnelling technologies
- Solar array – specific installation knowledge needed for safe installation
- Isolation of various sites – individual isolation points required and made prominent for emergency services
- Isolated setting – access to suppliers and emergency services in case of emergency. Mobile phone coverage etc. Access to water and food for workers. Temperature issues in remote locations
- Battery shed – correct sizing, siting and venting requirements of batteries as they cycle
- Homestead – occupants may interfere with workers, worksite and materials. Fence homestead off, liaise with occupants.

Question 22 (b)

Criteria	Marks
• Provides a comprehensive proposal for a safe and sustainable work schedule for this project • Uses correct industry standard terminology	9
• Provides a thorough proposal for a safe and sustainable work schedule for this project • Uses correct industry standard terminology	7–8
• Provides a sound proposal for a safe and sustainable work schedule for this project • Uses correct industry terminology	5–6
• Provides a basic proposal for a safe and/or sustainable work schedule for this project • Uses some industry terminology	3–4
• Provides some relevant information	1–2

Answers could include:

- Carry out a risk assessment
- Secure site by fencing
- Induct staff working at site
- Induct residents/instruct residents of intended works and time of site operations and estimated time of works
- Start from supply side:
  - erect solar array and wire up to aerial feed point
  - contract aerial supply contractors, or erect aerial supply from pole at array to battery shed
  - control driveway issues
  - ensure array is isolated from aerial cable
  - wire feed to battery regulation device and protection circuitry
  - wire in DC/AC converter and cable to output board
  - control driveway issues
  - connect feed from battery shed to homestead
  - test continuity and polarity from array to shed
  - enliven link array to shed
  - test feed and allow battery bank to charge for recommended period of time
  - enliven link shed to homestead
  - test feed with no load and stage load while testing
  - close construction site
  - ensure site left clean, tidy and organised. Rubbish is taken by contractors and workers back to regional centre.

2020 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	Sustainability — sustainable energy – pages 60–61	X	X	X	X	X	X		
2	1	Components, tools and equipment — hand and power tools – pages 30–31	X		X	X	X			X
3	1	Safety — safe work practices and procedures – pages 55–56	X		X		X		X	
4	1	Drawings, diagrams and compliance — compliance – pages 49–50	X		X		X			
5	1	Direct current circuits — capacitance – pages 43–44	X		X		X		X	X
6	1	Components, tools and equipment — hand and power tools – pages 30–31	X		X	X	X			X
7	1	Safety — safe work practices and procedures – pages 55–56	X		X		X		X	
8	1	Direct current circuits — series/parallel circuits – page 40	X		X		X		X	X
9	1	Direct current circuits — measuring and testing – pages 42–43	X		X		X		X	X
10	1	Safety — risk management – page 54	X		X		X		X	
11	1	Direct current circuits — capacitance – pages 43–44	X		X		X		X	X
12	1	Direct current circuits — capacitance – pages 43–44	X		X		X		X	X
13	1	Direct current circuits — resistors – page 41	X		X		X		X	X
14	1	Drawings, diagrams and compliance — electrical drawing and diagrams – pages 48–49	X		X		X			
15	1	Direct current circuits — series circuit – page 39	X		X		X		X	X

Section II

Question	Marks	Unit of competency / Element of competency	Employability skills (Please put an X where appropriate)							
			Communication	Teamwork	Problem-solving	Initiative and enterprise	Planning and organising	Self-management	Learning	Technology
16 (a)	2	Components, tools and equipment — hand and power tools – pages 30–31	X		X	X	X			X
16 (b)	4	Safety — safe work practices and procedures – page 55	X		X		X			X
17	3	Working in the industry — working with others – page 69	X	X	X	X	X	X	X	X
18	6	Sustainability – sustainable energy – page 60	X	X	X	X	X	X		
19 (a)	2	Direct current circuits — energy and power – page 38	X		X		X		X	X
19 (b)	4	Drawings, diagrams and compliance — electrical drawings and diagrams – pages 48–49	X		X		X			
20 (a)	3	Direct current circuits — series/parallel circuits – page 40	X		X		X		X	X
20 (b)	2	Direct current circuits — series/parallel circuits – page 40	X		X		X		X	X
20 (c)	3	Direct current circuits — series/parallel circuits – page 40	X		X		X		X	X
20 (d)	3	Direct current circuits — energy and power – page 38	X		X		X		X	X
20 (e)	3	Direct current circuits — series/parallel circuits – page 40	X		X		X		X	X

Section III

Question	Marks	Unit of competency / Element of competency	Employability skills (Please put an X where appropriate)							
			Communication	Teamwork	Problem-solving	Initiative and enterprise	Planning and organising	Self-management	Learning	Technology
21	15	Working in the industry — energy sector worker – pages 67–69	X	X	X	X	X	X	X	X

Section IV

Question	Marks	Unit of competency / Element of competency	Employability skills (Please put an X where appropriate)							
			Communication	Teamwork	Problem-solving	Initiative and enterprise	Planning and organising	Self-management	Learning	Technology
22 (a)	6	Safety — safe work practices and procedures – page 55	X		X		X		X	
22 (b)	9	Sustainability — energy sector workplace – pages 61–62 Working in the industry — energy sector worker – pages 67–68	X	X	X	X	X	X	X	X

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