2018 HSC Electrotechnology Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16 (a)

Criteria	Marks
• Identifies all bits correctly using correct terminology	3
• Identifies some bits correctly	2
• Identifies ONE bit correctly	1

Sample answer:

Task	*Type of bit*
∅ 90 mm hole in plasterboard	Hole saw / adjustable hole cutter
∅ 25 mm hole in timber stud	Spade bit / speed bore / auger
∅ 10 mm hole in mild steel	High Speed Steel bit / twist drill / carbide
∅ 8 mm hole in porcelain tiles	Diamond tip / masonry / tungsten

Question 16 (b)

Criteria	Marks
• Demonstrates a broad understanding of maintenance for power tools in respect to reciprocating saws • Lists a range of checks	3
• Demonstrates a sound understanding of maintenance for power tools in respect to reciprocating saws • Lists only a few checks	2
• Demonstrates a basic understanding of maintenance for power tools in respect to reciprocating saws • Identifies only one check	1

Sample answer:

Power tools can be properly maintained by checking the cord is in good condition, tagging and testing the lead and ensuring the blade isn't cracked.

Answers could include:

- Outer casing free of dust or oil and in good condition, not cracked or damaged
- No loose parts
- Replace blade if worn or teeth missing.

Question 17 (a)

Criteria	Marks
• Demonstrates an understanding of the differences in purpose between a wiring diagram and a circuit diagram	2
• Demonstrates an understanding of either a wiring diagram OR a circuit diagram	1

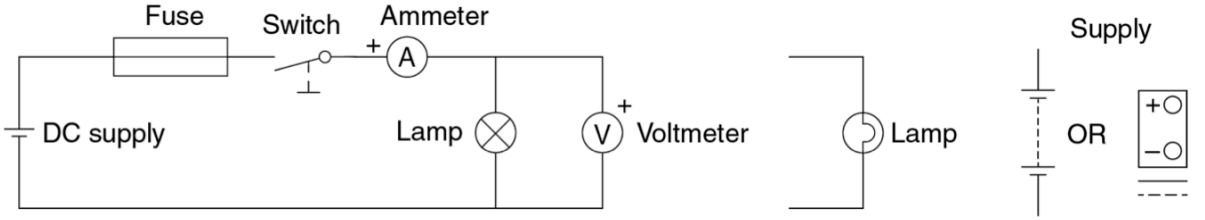
Sample answer:

A wiring diagram provides very detailed information to be used when installing equipment. A circuit diagram provides enough detail for the exact operation of a circuit and may be used when fault finding.

Question 17 (b)

Criteria	Marks
• Draws a working circuit that shows correct placement of components • Components are drawn correctly and labeled, including polarity	5
• Draws a working circuit that shows correct placement of most components • Most components are drawn correctly and labelled	3–4
• Demonstrates an elementary understanding of drawing circuit diagrams • Some components are placed correctly	1–2

Sample answer:



Note to markers:
Fuse must be placed directly after the positive terminal of the DC supply and switch must be placed before the remaining components to receive full marks.

Question 18 (a)

Criteria	Marks
• Demonstrates a sound understanding of safety issues related to unfinished electrical work • Uses correct industry terminology	3
• Demonstrates some understanding of safety issues related to unfinished electrical work • Uses correct industry terminology	2
• Demonstrates a basic understanding of safety issues related to unfinished electrical work	1

Sample answer:

If electrical work is left unfinished, the workplace must be left in a safe state by:

- terminating any exposed conductors and physically securing any exposed conductors
- tagging, lock-out of the electrical equipment and taping off the workplace area
- informing affected persons at the workplace the work is not complete and advising of potential hazards and/or work to be completed.

Question 18 (b)

Criteria	Marks
• Demonstrates a thorough understanding of precautions required when carrying out electrical procedures • Identifies issues related to each area of: – working at heights – working in a public area – isolation procedures	4
• Demonstrates a sound understanding of precautions required when carrying out electrical procedures • Identifies some issues related to: – working at heights – working in a public area – isolation procedures	2–3
• Demonstrates a basic understanding of precautions required when carrying out electrical procedures • Identifies ONE of the issues related to: – working at heights – working in a public area – isolation procedures	1

Sample answer:

- Inform all stakeholders of work and safety issues related to completing the task, eg loss of power, barricade of work area, duration of task
- Isolate lighting circuit including tag/lock-out
- Implement working at height safety requirements, eg portable scaffolding, harness
- Organise clean-up on completion of task and inform site supervisor of completion.

Question 19

Criteria	Marks
• Demonstrates a thorough understanding of how to rectify the operation of a single socket outlet • Provides the correct steps required to isolate, modify and re-test a socket outlet • Uses correct industry terminology	4
• Demonstrates a sound understanding of how to rectify the operation of a single socket outlet • Provides some steps required to isolate, modify and re-test a socket outlet • Uses some industry terminology	2–3
• Demonstrates a basic understanding of how to rectify the operation of a single socket outlet	1

Sample answer:

- Isolate power circuit including tag/lock-out and ensure socket outlet is isolated
- Remove the socket outlet and ensure that the active wire is de-energised
- Swap and re-terminate active and neutral conductors
- Re-install socket outlet and energise circuit
- Re-test socket outlet to confirm correct polarity
- Test the test equipment.

Question 20 (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 answers:

$$R_T = R_1 + \left(\frac{1}{\frac{1}{R_2} + \frac{1}{R_3 + R_4} + \frac{1}{R_5}} \right) = 10 + \left(\frac{1}{\frac{1}{30} + \frac{1}{10 + 20} + \frac{1}{30}} \right)$$

$$= 20\ \Omega$$

Also,

$$R_T = R_1 + \left(\left({R_2}^{-1} + \left(R_3 + R_4 \right)^{-1} + {R_5}^{-1} \right)^{-1} \right)$$

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:

$$R_T = R_1 + R_2$$
$$= 10 + 30 = 40\ \Omega$$
$$I_T = \frac{V}{R_T} = \frac{24}{40} = 0.6\ A \quad \text{or} \quad 600\ mA$$

Question 20 (c)

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:

$$R_T = R_1 + \left(\frac{1}{\frac{1}{R_2} + \frac{1}{R_5}} \right) = 10 + \left(\frac{1}{\frac{1}{30} + \frac{1}{30}} \right) = 25\ \Omega$$

$$I_T = \frac{\mathrm{V}}{R_T} = \frac{24}{25} = 0.96\ A$$

$$\mathrm{V}_1 = I_T R_1 = 0.96 \times 10 = 9.6\ \mathrm{V}$$

Question 20 (d)

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:

$$R_T = R_1 + R_2 = 10 + 30 = 40\ \Omega$$

$$P = \frac{\mathrm{V}^2}{R_T} = \frac{24^2}{40} = 14.4\ W$$

Question 20 (e)

Criteria	Marks
• Provides a thorough explanation for why the voltmeter is reading 14.4 V using circuit analysis • Provides the correct operational state for both switches	3
• Provides a sound explanation for why the voltmeter is reading 14.4 V using circuit analysis OR correct operation state	2
• Provides a basic explanation for why the voltmeter is reading 14.4 V	1

Sample answer:

S_1 is open;
S_2 is closed.

This is due to +ve side of the voltmeter being at the potential difference after R_1 ($24\,\text{V} - 9.6\,\text{V} = 14.4\,\text{V}$) and –ve side voltmeter being at $0\,\text{V}$ circuit potential (electrical common or ground). Therefore, the difference is $14.4\,\text{V}$.

Section III

Question 21

Criteria	Marks
• Demonstrates a comprehensive understanding of sustainable energy supply using a range of examples • Provides a logical and clear response to show how governments in Australia, industry and consumers can address the issues of climate change and sustainable energy supply • Uses correct industry terminology	13–15
• Demonstrates a substantial understanding of sustainable energy supply • Provides a logical response to show how governments in Australia, industry and consumers can address the issues of climate change and sustainable energy supply • Uses correct industry terminology	10–12
• Demonstrates a sound understanding of sustainable energy supply • Provides a response that considers how governments in Australia, industry and consumers can address the issues of climate change and sustainable energy supply • Uses correct industry terminology	7–9
• Demonstrates some understanding of sustainable energy supply • Provides a response that considers governments in Australia, industry and/or consumers	4–6
• Demonstrates a basic understanding of sustainable energy supply	1–3

Answers could include:

Governments:

- Use of green energy alternatives for base supply, eg wind, solar, wave power
- Ways of meeting peak demands, eg hydro-regeneration, battery storage
- Incentive schemes for industry and domestic consumers, eg self-generation, energy-efficient products.

Industry/domestic consumers:

- Conversion to energy-efficient products, eg LED lighting
- Change of practice, eg setting of air-conditioners' temperatures
- Best practice in the use of 'time of use' metering, eg washing machine or pool pumps.

The electrotechnology industry:

- Development of energy-efficient products
- Collaboration in designing buildings to require less energy
- Education of consumers on how to conserve energy
- Training of energy sector workers in best practice
- Use of self-generation technologies.

Section IV

Question 22 (a)

Criteria	Marks
• Provides a range of alternatives giving the key features of controlling the security lights	3
• Provides some alternatives giving the key features of controlling the security lights	2
• Identifies ONE or TWO methods of controlling the security lights	1

Sample answer:

There are a variety of options for controlling the security lights. For example, manual switching is easy to install but it may be left on and waste electricity. There are also pre-programmed timers which turn on and off as required, but they need adjusting for daylight saving. Light sensors are good to use because they come on at sunset or low light; however, they come on when not required.

Question 22 (b)

Criteria	Marks
• Demonstrates a comprehensive understanding of site safety to carry out the upgrades • Identifies a range of safety areas • Uses industry-standard terminology	4
• Demonstrates a sound understanding of site safety to carry out the upgrades • Identifies some safety areas	2–3
• Demonstrates a limited understanding of site safety to carry out the upgrades • Identifies limited safety areas that need control	1

Sample answer:

There are several safety considerations to be taken into account while the upgrades are being carried out. In the public area stakeholders such as centre staff and visitors will need to be notified. There will need to be adequate signage and barricades need to be erected. When working at height elevated work platforms such as boom and scaffolding are to be used, and properly trained and certified workers must use safety harnesses.

Answers could include:

Public area:

- Notify stakeholders affected, eg centre staff, visitors
- Barricade area/signage.

Working at height:

- Use of elevated work platforms, eg booms, scaffolding
- Safety harnesses
- Training/certification of use of equipment.

Working with electricity:

- Induction – white card and site
- Safe work method statements (SWMS)
- Safe isolation of electrical supply
- Risk assessment.

Site clean up:

- Removal and disposal of waste
- Removal of barriers
- Inform appropriate personnel.

Question 22 (c)

Criteria	Marks
• Demonstrates a comprehensive understanding of a logical process to complete the lighting upgrades • Demonstrates a comprehensive understanding of the requirements to install equipment relevant to the electrotechnology industry • Uses industry-standard terminology	8
• Demonstrates a thorough understanding of a logical process to complete the lighting upgrades • Demonstrates a thorough understanding of the requirements to install equipment relevant to the electrotechnology industry • Uses industry-standard terminology	6–7
• Demonstrates a sound understanding of a logical process to complete the lighting upgrades • Demonstrates an understanding of the requirements to install equipment relevant to the electrotechnology industry • Uses some industry-standard terminology	4–5
• Demonstrates some understanding of a logical process to complete the lighting upgrades • Demonstrates an understanding of some requirements to install equipment relevant to the electrotechnology industry • Uses some terminology	2–3
• Demonstrates a basic understanding of electrical installations • Considers one or two aspects of the installation	1

Answers could include:

Planning and site preparation:

- Ordering of materials, cables, lights, switches to specifications required, lifting equipment hire
- Communication with building manager for site access
- Obtain work permits to shut down power to relevant lights
- Completion of safe work method statement (SWMS).

Carry out work:

- Isolation of light circuit, using the appropriate isolation procedure (test, lockout/tag)
- Set up safety barriers
- Set up work platform
- Remove existing lighting
- Replace existing lights
- Run new circuit from switchboard to new light points and controls
- Run cable in conduits as required and fix conduits to wall
- Fix light fittings to brick wall using external dynabolts or other external fixings
- Terminate cables to controllers, switches and lights
- Install new circuit breaker and residual current device (RCD) to existing lighting
- Test and commission lights
- Complete the Certificate of Compliance of Electrical Work
- Clean up site and advise building manager of completion of work.

2018 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	Safety — risk management – p54			X					X
2	1	Components, tools and equipment — hand and power tools – p30–31 Safety — safe work practices and procedures – p55				X	X			
3	1	Components, tools and equipment — hand and power tools – p30–31								X
4	1	Direct current circuits — safe work practice and procedures – p37, and energy and power – p38	X		X					X
5	1	Components, tools and equipment — fixing, securing and mounting accessories – p31–32				X	X			
6	1	Direct current circuits — resistors – p41							X	X
7	1	Direct current circuits — parallel circuits – p40			X				X	
8	1	Working in the industry — anti-discrimination – p70	X	X	X	X		X		
9	1	Direct current circuits — resistors – p41			X					X
10	1	Direct current circuits — electrical current – p38, drawings, diagrams and compliance — compliance – p49–50					X			
11	1	Safety — safe work practices and procedures – p55–56			X		X		X	
12	1	Direct current circuits — series circuits – p39			X				X	
13	1	Direct current circuits — measuring and testing – p42–43	X		X					X
14	1	Components, tools and equipment — hand and power tools – p30–31			X		X			X

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
15	1	Direct current circuits — electrical current – p38							X	X

Section II

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
16 (a)	3	Components, tools and equipment — hand and power tools – p30–31					X			X
16 (b)	3	Components, tools and equipment — hand and power tools – p30–31				X				
17 (a)	2	Drawings, diagrams and compliance — electrical drawings and diagrams – p48–49	X		X					
17 (b)	5	Drawings, diagrams and compliance — electrical drawings and diagrams – p48–49	X				X			
18 (a)	3	Safety — WHS compliance – p53–54, safe work practices and procedures – p55–56	X		X		X		X	
18 (b)	4	Working in the industry — energy sector worker – p67–69			X	X	X	X		
19	4	Safety — safe work practices and procedures – p55–56 Working in the industry — energy sector worker – p67			X	X			X	X
20 (a)	2	Direct current circuits — series circuits – p39, parallel circuits – p40			X				X	
20 (b)	2	Direct current circuits — series circuits – p39, parallel circuits – p40			X		X		X	
20 (c)	2	Direct current circuits — series circuits – p39, parallel circuits – p40			X		X		X	
20 (d)	2	Direct current circuits — series circuits – p39, parallel circuits – p40			X		X		X	
20 (e)	3	Direct current circuits — series circuits – p39, parallel circuits – p40			X		X		X	X

Section III

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
21	15	Sustainability — environment – issues and sustainability – p60 Sustainability — climate change – p60 Sustainability — sustainable energy – p60–61 Working in the industry — nature of the industry – p65	X	X	X	X	X			X

Section IV

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
22 (a)	3	Sustainability — energy sector workplace – p61–62 Working in the industry — energy sector worker – p67–69	X		X	X	X		X	X
22 (b)	4	Safety — safe work practices and procedures – p55–56	X		X		X			
22 (c)	8	Working in the industry — energy sector worker – p67–69	X	X	X	X	X	X		X