BOARD OF STUDIES
NEW SOUTH WALES

2013 HSC Electrotechnology Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16 (a)

Criteria	Marks
• Identifies appropriate fastener and provides a comprehensive justification of choice	4
• Identifies appropriate fastener and provides detailed justification of choice	3
• Identifies appropriate fastener and provides adequate justification of choice	2
• Identifies appropriate fastener and provides limited justification of choice	1

Sample answer:

The sheet metal of 1.6 mm is thin enough that it could be suitably drilled to use fasteners that include pop rivets or machine screws.

Consideration should be given to the function or use to select the method used. This includes vibration, movement, strength and service life. In this case my choice would be pop rivets. This requires a drill hole to suit the diameter of the rivet. Installation using a rivet gun to compress the rivet and break the mandrel. Other benefits would be cost of rivets being cheap and the aesthetic finish they provide on the finished product.

Answers could include:

- Pop rivets
- Hot rivets
- Sheet metal screws
- Machine screws
- NOT spot welds

Reasons for choice of fasteners:

- Function
- Properties
  - Stiffness
  - Strength
  - Service life
- Requirements of the device
  - Magnitude
  - Direction of forces
- Installation process
- Aesthetic considerations
- Cost
- Electrolytic effect
  - Pop rivets or fasteners should be made from similar materials to sheet metal

Question 16 (b)

Criteria	Marks
• Outlines at least 2 pieces of PPE and at least 2 preoperational checks	4
• Outlines at least 2 pieces of PPE and 1 preoperational check OR 1 piece of equipment and at least 2 preoperational checks	3
• Outlines 1 piece of PPE and 1 preoperational check	2
• Outlines 1 piece of PPE OR 1 preoperational check	1

Sample answer:

Before using this power tool it needs to be visually examined by the operator. Checks should be made for damage to lead, 3 pin plug and cable strain. The casing should be checked for breaks or cracks. The trigger should be checked for operation and the unit should be free of dust, paint and dirt. The unit should also be tagged to show it has been recently checked.

When using this type of power tool the operator should be wearing long sleeves, long pants, protective footwear, protective gloves, eye goggles, hearing muffs. The angle grinder should be fitted with a specific cutting disc and held securely when operating.

Answers could include:

- Tool tag current
- Lead undamaged
- Machine serviceable
- Cutting disc, not grinding disc
- Material held securely
- PPE such as ear protection, eye protection, long sleeved shirt, gloves, long trousers, protective footwear
- Screen or cutting bay

Question 17 (a)

Criteria	Marks
• Provides a comprehensive description of appropriate housekeeping practices	4
• Provides a detailed description of appropriate housekeeping practices	3
• Provides an adequate description of appropriate housekeeping practices	2
• Provides a limited description of appropriate housekeeping practices	1

Sample answer:

A major part of work, health and safety is good housekeeping. When undertaking any job there are essential housekeeping practices that include stacking tools and materials in a neat and safe manner. The work area needs to be clean and safe for work and allow for potential of erecting ladders or scaffolding. If working in a public area consideration needs to be given to barriers, signs or marker tape to warn the public. Once the job has been completed the area must be left clean and in a safe manner. All waste must be disposed of in keeping with environmental requirements.

Answers could include:

- Tools and equipment stored correctly
- Chemicals correctly stored and labelled
- Work areas clean and free from debris
- Waste is disposed of correctly (bins available)
- Barriers and warning signs in place and appropriate
- Materials stacked/stored safely out of traffic ways
- Environmental practices followed correctly
- Surfaces are safe and suitable for their use
- No slip or trip hazards

Question 17 (b)

Criteria	Marks
• Provides a comprehensive explanation of safety measures to reduce risks	4
• Provides a detailed explanation of safety measures to reduce risks	3
• Provides an adequate explanation of safety measures to reduce risks	2
• Provides a limited explanation of safety measures to reduce risks	1

Sample answer:

A ceiling cavity is generally a confined space with a number of other hazards that may include fibreglass insulation, electrical cabling, pipework, poor lighting and excessive temperatures.

To implement sufficient control measures for such hazards, actions could include installing lead-lights or flood lighting. Removal of roofing material may help ventilation and reduce temperature or forced ventilation may be needed. Workers should be wearing long sleeves and long pants with a breathing mask to protect them against insulation particles. Finally, workers should take regular breaks and drink water to remain hydrated.

Answers could include:

- Eliminate temperature – come back later
- Engineered solution – remove tiles for better ventilation
- Forced ventilation
- Administrative measures – rotating work between several employees
- Take additional water for regular rehydration – PPE
- Consider alternative positioning / process – substitution
- Confined spaces
- Insulation – Fibreglass, paper pulp, polyester, sarking
- Tread only on timbers, not plaster or gyprock ceiling
- Long clothing, gloves, respiratory masks
- Walking or laying platforms
- Appropriate lighting to work by
- Tarpaulins to cover roof if rain starts

Question 18 (a)

Criteria	Marks
• Provides correct answer and shows relevant working	3
• Correctly identifies load current AND • Correctly calculates I_3	2
• Correctly identifies load current OR correctly calculates I_3	1

Sample answer:

Load current = 30 mA + 50 mA = 80 mA
I_3 = 10% of load current = 0.1×80 mA = 8 mA
Total circuit current = load current + I_3 = 80 mA + 8 mA = 88 mA

Question 18 (b)

Criteria	Marks
• Correctly calculates voltage drop across R_1	1

Sample answer:

$$\mathbf{V}_{\text{supply}} - \mathbf{V}_{\text{load}} = 240\mathbf{V} - 200\mathbf{V} = 40\mathbf{V}$$

Question 18 (c)

Criteria	Marks
• Provides correct answer and shows relevant working	2
• Correctly identifies appropriate current OR voltage drop OR identifies correct formula	1

Sample answer:

$$\text{R} = \frac{V}{I}$$

$$\text{Resistance} = \frac{80}{0.038} = 2105 \text{ ohms}$$

Question 18 (d)

Criteria	Marks
• Provides correct answer and shows relevant working	2
• Correctly identifies appropriate current OR voltage drop OR identifies correct formula	1

Sample answer:

$$R = \frac{V}{I}$$

$$\text{Resistance} = \frac{120}{0.008} = 15000 \text{ ohms or } 15\text{k ohms}$$

Question 19 (a) (i)

Criteria	Marks
• Correctly selects appropriate formula AND • Correctly calculates lamp resistance AND • Correctly calculates total circuit resistance	3
• Correctly selects appropriate formula AND • Correctly calculates lamp resistance	2
• Correctly selects appropriate formula OR • Correctly calculates lamp resistance	1

Sample answer:

$P = I^2R$

Lamp resistance = $\frac{20}{2^2} = 5$ ohms

Total circuit resistance = 20 + 5 = 25 ohms

OR $\frac{50V}{2A} = 25$ ohms

Question 19 (a) (ii)

Criteria	Marks
• Correctly selects appropriate formula AND • Correctly identifies circuit current AND • Correctly calculates voltage drop across R_1	3
• Correctly selects appropriate formula AND • Correctly identifies circuit current	2
• Correctly selects appropriate formula OR • Correctly identifies circuit current	1

Sample answer:

• $V_1 = I_{total} \times R_1$

• Circuit current is 2A as per specification of lamp

• $V_1 = 2 \times 20 = 40V$

Question 19 (b) (i)

Criteria	Marks
• Correctly transposes 100m ohms into 0.1 ohms • Calculates new parallel resistance value AND • Calculates new total circuit resistance AND • Calculates new circuit current	4
• Correctly transposes 100m ohms into 0.1 ohms • Calculates new parallel resistance value AND • Calculates new total circuit resistance	3
• Correctly transposes 100m ohms into 0.1 ohms OR identifies two formulas • Calculates new parallel resistance value	2
• Correctly transposes 100m ohms into 0.1 ohms OR identifies one formula	1

Sample answer:

$100 \text{ m}\Omega = 0.1\ \Omega$

New parallel resistance $= \dfrac{1}{\left(\left(\dfrac{1}{5}\right)+\left(\dfrac{1}{0.1}\right)\right)} = \dfrac{1}{0.2+10} = 0.09$ ohms

New total resistance $= 20 + 0.09 = 20.09$ ohms

New circuit current $= \dfrac{V_{supply}}{R_{total}} = \dfrac{50}{20.09} = 2.48$ A

Question 19 (b) (ii)

Criteria	Marks
• Correctly identifies the effect of the current	1

Sample answer:

Lamp will become dimmer.

Section III

Question 20

Criteria	Marks
• Provides a comprehensive explanation of safe working practices, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates clearly and logically, using standard industry terminology • Communicates ideas and information effectively in a well reasoned and cohesive response • Demonstrates an in-depth understanding of electrotechnology functions in reference to the scenario used in the question	13–15
• Provides a detailed explanation of safe working practices, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates in an acceptable manner using standard industry terminology • Communicates ideas and information consistently in a reasoned and cohesive response • Demonstrates an understanding of electrotechnology functions in reference to the scenario used in the question	10–12
• Provides adequate explanation of safe working practices, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates using some industry terminology • Communicates ideas and information adequately • Demonstrates a basic understanding of electrotechnology functions in reference to the scenario used in the question	7–9
• Provides a basic explanation of safe working practices, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates using limited industry terminology • Communicates ideas and information in a basic manner • Demonstrates a basic understanding of electrotechnology functions in reference to the scenario given	4–6
• Provides a limited description of some safe working practices, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates using limited industry terminology • Communicates ideas and information in a limited manner • Demonstrates limited understanding of electrotechnology functions in reference to the scenario used in the question	1–3

Sample answer:

This will include a team effort so a meeting should be held to discuss safe work methods that will include a risk assessment. The site should be visited prior to commencement of work to assess issues such as access by machinery and vehicles, overhead wires, location of residences or nearby businesses that may be affected by noise or restricted access, traffic control requirements and other services such as gas, sewer, water and communication cables. Consult 1100 for information before digging. Liaise with site foreman or manager to create good communication during the project. This will include a time line of works with start and finish dates. Discussions may be required to work out times the jobs can be done. This could be daytime or nighttime.

With the job being undertaken there would be many ongoing issues that would need attention such as keeping at least one lane open for driveway access, heavy machinery blocking access while digging or when cable installation takes place. There would also have to be allowances made for waste disposal of concrete and soil to meet environmental needs. Generally a waste skip is used; the location of this needs to be planned.

After the cables have been installed underground to Australian standard AS3000:2007 there is the need to repair the site. This could include concreting, asphalting, back filling trenches and re-turfing.

Co-ordination is needed with the local energy authority as power supply would need to be cut off to remove the overhead supply wires. Local homes and businesses affected will need prior notification of power loss.

The new underground cables will have to be tested for continuity, insulation resistance polarity, correct circuit connections and identified prior to being energised.

These new cables need to be ready at the same time the overhead cables are de-energised and removed.

Answers could include:

Safe Work Methods	**Customer Service**	**Access/Site Issues**
• Risk assessment • Dial before you dig • Check for – Water – Electrical – Telstra – Gas – Sewer – Storm water • Isolation • Lockout • Tag • Traffic Control (foot & vehicle) • Installation requirement as per AS3000	• Inform site or building manager • Timeline of works • Start date • Finish date • Times of work – Morning – Middle of day – Evening • Constant feedback to Site Manager • Supply loss • Information to driveway users	• Traffic control • One lane always to be open • Heavy machinery access to site • Landscape of site sloping ground etc • Method of trenching • Locations of other services • Change over arrangement • Removing old over-head cables

Section IV

Question 21 (a)

Criteria	Marks
• Provides a detailed explanation of safe work practices required	5
• Provides an extensive explanation of safe work practices required	4
• Provides an adequate explanation of safe work practices required	3
• Provides a basic explanation of safe work practices	2
• Provides a limited explanation of safe work practices	1

Sample answer:

For this task a range of safe work practices need to be adhered to. As low voltage electricity is in use, the board will need to be tested, isolated from supply and tagged to eliminate unauthorised reconnection. The workgroup will need at least 2, possibly 3 workers; 1 person being an overseer/spotter. All workers need the correct PPE for the task. The work group needs to take extra equipment such as First Aid kit, non-conductive crook (or other means to disengage an electrocution victim from supply), fire extinguisher suitable for use in electrical situations such as CO_2 or dry chemical, and a mobile phone for emergency communications. All work group members should also be appropriately trained, certified, competent, confident, not drug affected, and current. All powered tools tested and tagged.

Question 21 (b)

Criteria	Marks
• Provides a comprehensive sequence of actions, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates clearly and logically, using standard industry terminology • Communicates ideas and information effectively in a well reasoned and cohesive response • Demonstrates an in-depth understanding of electrotechnology functions in reference to the scenario used in the question	9–10
• Provides a detailed sequence of actions, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates in an acceptable manner using standard industry terminology • Communicates ideas and information consistently in a reasoned and cohesive response • Demonstrates an understanding of electrotechnology functions in reference to the scenario used in the question	7–8
• Provides adequate sequence of actions, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates using some industry terminology • Communicates ideas and information adequately • Demonstrates a basic understanding of electrotechnology functions in reference to the scenario used in the question	5–6
• Provides a basic sequence of actions, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates using limited industry terminology • Communicates ideas and information in a basic manner • Demonstrates a basic understanding of electrotechnology functions in reference to the scenario given	3–4
• Provides a limited sequence of actions, tools, equipment and processes that should be implemented in the given electrotechnology situation • Communicates using limited industry terminology • Communicates ideas and information in a limited manner • Demonstrates limited understanding of electrotechnology functions in reference to the scenario used in the question	1–2

Sample answer:

The first action by any person is not to become a victim yourself. If there were other colleagues around or someone within hearing I would yell to them to call 000 to get an ambulance and fire brigade.

Actions at this stage need to be quick yet safe. The first task would be to consider removing power to the sub board. I would instruct someone to do this, while I locate a non-conductive object to pull my colleague away from the switchboard to a safe area. I would then assess my colleague for consciousness and pulse. If necessary perform CPR.

Once my colleague has been stabilised or professional help has arrived I then need to return to the switchboard to assess the fire situation. I need to consider the risk to other people to raise an alarm for evacuation, do I have the knowledge and skills to fight the fire, and are the necessary tools available to use.

To fight the fire I would need to use a fire extinguisher suitable on electrical installation. This is dry chemical powder or carbon dioxide. The extinguisher should be used with the APSS technique.

After the emergency is over it is mandatory to complete necessary paperwork to report the incident to my supervisor and Workcover.

Electrotechnology

2013 HSC Examination Mapping Grid

Section I

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
1	1	UEENEEE004B Solve problems in multiple path d.c. circuits; p78	X						X	
2	1	UEENEEE001B Apply WHS practices in the workplace; p34	X	X		X		X		
3	1	UEENEEE001B Apply WHS practices in the workplace; p29 and p36	X		X			X		
4	1	UEENEEE004B Solve problems in multiple path d.c. circuits; p78			X				X	
5	1	UEENEEE048B Carry out routine work activities in an electrotechnology environment; p116			X			X		X
6	1	UEENEEE005B Fix and secure equipment; p97				X	X	X	X	
7	1	UEENEEE004B Solve problems in multiple path d.c. circuits; p78	X		X				X	
8	1	UEENEEE003B Solve problems in extra-low voltage single path circuits; p66			X				X	
9	1	UEENEEE005B Fix and secure equipment; p92			X		X			
10	1	UEENEEE003B Solve problems in extra-low voltage single path circuits; p64 Appendix 2.8.2.1 P137							X	
11	1	UEENEEE004B Solve problems in multiple path dc circuits; p73			X				X	
12	1	UEENEEE004B Solve problems in multiple path d.c. circuits; p77			X				X	
13	1	UEENEEE004B Solve problems in multiple path d.c. circuits; p78			X				X	
14	1	UEENEEE004B Solve problems in multiple path d. c. circuits; p73	X		X				X	
15	1	UEENEEE003B Solve problems in extra-low voltage single path circuits; p64			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
16a	4	UEENEEE005B Fix and secure equipment; p93 UEENEEE002B Dismantle, assemble and fabricate electrotechnology components; p51			X				X	X
16b	4	UEENEEE005B Fix and secure equipment; p96 UEENEEE002B Dismantle, assemble and fabricate electrotechnology components; p52					X	X	X	X
17a	4	UEENEEE001B Apply WHS practices in the workplace; p31 and 35	X				X	X		
17b	4	UEENEEE001B Apply WHS practices in the workplace; p31 and 35 p29	X	X	X	X	X	X		X
18a	3	UEENEEE003B Solve problems in extra-low voltage single path circuits; p65	X		X				X	
18b	1	UEENEEE003B Solve problems in extra-low voltage single path circuits; p65	X		X				X	
18c	2	UEENEEE003B Solve problems in extra-low voltage single path circuits; p65	X		X				X	
18d	2	UEENEEE003B Solve problems in extra-low voltage single path circuits; p65	X		X				X	
19a(i)	3	UEENEEE003B Solve problems in extra-low voltage single path circuits; p65	X		X				X	
19a(ii)	3	UEENEEE004B Solve problems in multiple path dc circuits p78	X		X				X	
19b(i)	4	UEENEEE004B Solve problems in multiple path dc circuits p78	X		X				X	
19b(ii)	1	UEENEEE004B Solve problems in multiple path dc circuits; p78	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
20	15	UEENEEE001B Apply WHS practices in the workplace; p39 UEENEEC010B Deliver a service to customers; p15	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
21a	5	UEENEEE001B Apply WHS practices in the workplace UEENEEE005B Fix and secure equipment; p91 UEENEEE048B Carry out routine work activities in an electrotechnology environment; p111	X	X	X	X	X	X		X
21b	10	UEENEEE001B Apply WHS practices in the workplace UEENEEE005B Fix and secure equipment; p91 UEENEEE048B Carry out routine work activities in an electrotechnology environment; p108 Appendix 4; p289	X	X	X	X	X	X		X