

2016 HSC Electrotechnology Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16

| Criteria | Marks |
|--|-------|
| • Outlines an advantage and disadvantage for each of the sources of power generation | 4 |
| • Demonstrates some understanding of the advantages and disadvantages | 2–3 |
| • Shows a limited understanding of power generation | 1 |

Sample answer:

| <i>Power Generation</i> | <i>Advantage</i> | <i>Disadvantage</i> |
|-------------------------|---|--|
| Coal | Can regulate the supply of generation as required | Environmental impact of coal supply |
| Wind | Clean energy Distributed supply by households possible | Not a consistent source of power Not a consistent source of power |

Question 17 (a)

| Criteria | Marks |
|---|-------|
| • Justifies TWO safety instructions that relate to working in a roof cavity | 3 |
| • Justifies ONE safety instruction that relates to working in a roof cavity OR • Identifies TWO safety instructions that relate to working in a roof cavity | 2 |
| • Identifies ONE safety consideration that relates to working in a roof cavity | 1 |

Sample answer:

Support body weight on rafters/joists so you don't fall through the ceiling and injure yourself.
Limit time in the roof due to heat so as not to get heat exhaustion.

Answers could include:

Use a dust mask to protect lungs. Inform someone you are going into the roof in case you become trapped.

Question 17 (b)

| Criteria | Marks |
|---|-------|
| • Lists THREE manual handling procedures a worker should use when lifting | 3 |
| • Lists TWO manual handling procedures a worker should use when lifting | 2 |
| • Lists ONE manual handling procedure a worker should use when lifting | 1 |

Sample answer:

- Bend knees with a straight back
- Only lift up to 20kg
- Keep load as close to the body as possible

Answers could include:

- Short carry distance
- Have supervision
- Use lifting aids
- Use correct PPE where required
- Plan your route

Question 18 (a)

| Criteria | Marks |
|--|-------|
| • Correctly identifies the missing steps | 2 |
| • Correctly identifies one step OR • Identifies two correct steps in the wrong order | 1 |

Sample answer:

| Step | |
|------|--|
| 1 | Identify circuit |
| 2 | Advise personnel |
| 3 | <i>Verify test equipment on a known source</i> |
| 4 | Isolate circuit |
| 5 | <i>Tag/lockout circuit</i> |
| 6 | Test circuit |
| 7 | Verify test equipment on a known source |

Question 18 (b)

| Criteria | Marks |
|--|--------------|
| • Demonstrates a comprehensive understanding of the need to verify test equipment and its effect if faulty | 3 |
| • Demonstrates a sound understanding of the need to verify test equipment | 2 |
| • Demonstrates a basic understanding of how equipment is tested | 1 |

Sample answer:

The verifying of test equipment is important because if the equipment broke during the isolation procedure the circuit may still be live. This would mean the workers could be electrocuted.

Question 19

| Criteria | Marks |
|--|--------------|
| <ul style="list-style-type: none"> • Demonstrates a comprehensive depth of knowledge and understanding of legislation in the electrotechnology industry • Communicates cause and effect of ONE piece of legislation using relevant workplace examples and industry terminology | 5 |
| <ul style="list-style-type: none"> • Demonstrates a sound knowledge and understanding of legislation in the electrotechnology industry • Communicates cause and effect of ONE piece of legislation using relevant workplace examples and industry terminology | 4 |
| <ul style="list-style-type: none"> • Demonstrates a sound knowledge and understanding of legislation in the electrotechnology industry OR <ul style="list-style-type: none"> • Communicates cause and effect of ONE piece of legislation using relevant workplace examples and some industry terminology | 3 |
| <ul style="list-style-type: none"> • Demonstrates a basic knowledge and understanding of legislation in the electrotechnology industry • Uses limited relevant workplace examples and some industry terminology | 2 |
| <ul style="list-style-type: none"> • Demonstrates a basic knowledge and understanding of legislation in the electrotechnology industry OR <ul style="list-style-type: none"> • Uses limited relevant workplace examples and some industry terminology | 1 |

Sample answer:

Work health and safety legislation (*Work Health and Safety Act 2011*(NSW)) allows for employers to ensure the safety and wellbeing of employees in their workplace. If employees are exposed to hazards that can be eliminated, an injury may occur that leads to time off work to recover. This may result in loss of earnings for the employee and reduced productivity for the employer.

Answers could include:

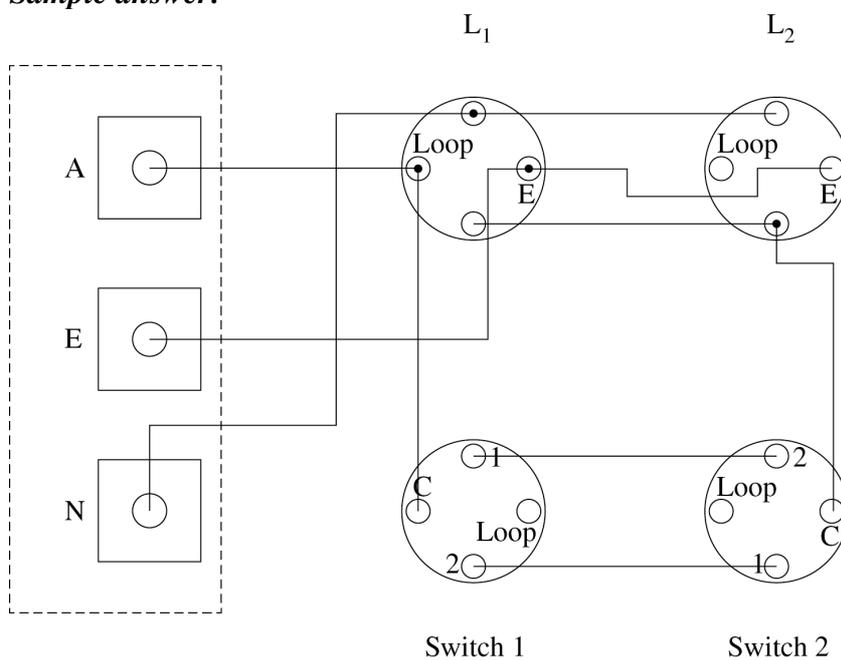
Possible legislation:

- *Work Health and Safety Act 2011* (NSW)
- *Protection of the Environment Operations Act 1997* (NSW)
- *Clean Energy Act 2011* (Cth)
- *Electricity Supply Act 1995* (NSW)
- *Electricity (Consumer Safety) Act 2004* (Cth)

Question 20

| Criteria | Marks |
|---|-------|
| <ul style="list-style-type: none"> • Demonstrates a clear understanding of two-way switching • Completes diagram to AS3000 standard | 4 |
| <ul style="list-style-type: none"> • Demonstrates a clear understanding of two-way switching, with minor errors OR <ul style="list-style-type: none"> • Shows correct connection of neutral and earth and at least one active conductor correct | 2–3 |
| <ul style="list-style-type: none"> • Demonstrates a partial understanding of two-way switching OR <ul style="list-style-type: none"> • Demonstrates an understanding of earthing and neutral connections | 1 |

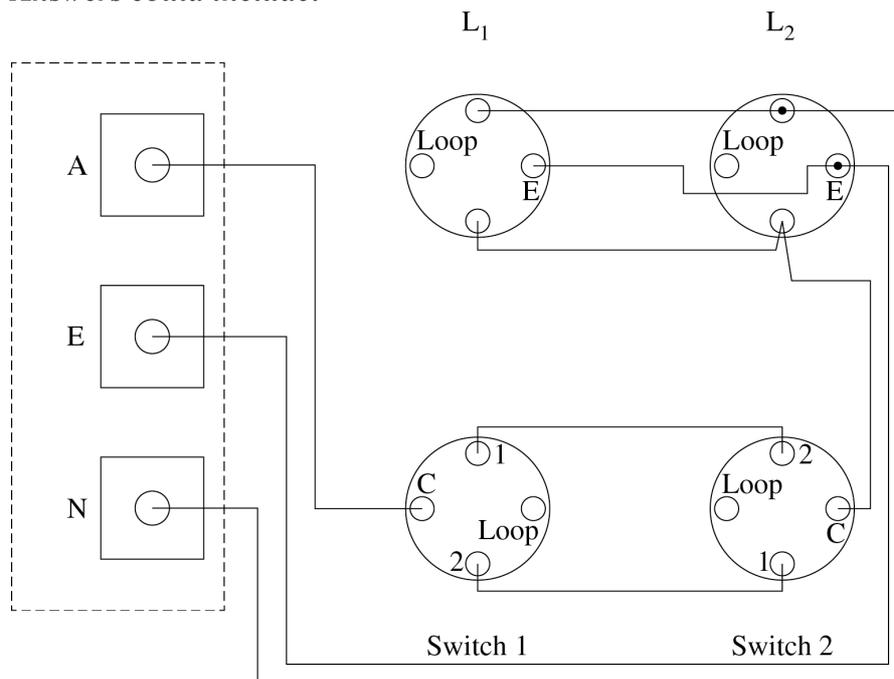
Sample answer:



Note to markers:

1. Switching of the neutral is prohibited under AS3000 and not accepted for full marks. Can only attract one mark if circuit is correct but switched at neutral.
2. Loop at light or loop at switch are both accepted as correct.

Answers could include:



Question 21 (a)

| Criteria | Marks |
|---|-------|
| • Correct formula AND correct substitution of values are used | 2 |
| • Correct formula OR correct substitution of values is used | 1 |

Sample answer:

$$V_{1,3} = IR = 1 \times (3 + 6) = 9V$$

$$V_5 = V_T - V_1 = 15 - 9 = 6V$$

Question 21 (b)

| Criteria | Marks |
|--|-------|
| • Uses correct formulae AND correctly substitutes values | 3 |
| • Substitutes values into formulae, with minor error | 2 |
| • Uses one correct formula OR correct substitution of values | 1 |

Sample answer:

$$V_{1,3} = 9V$$

$$I_2 = V_{1,3} / R = 9V / (2 + 4) = 9/6 = 1.5A$$

$$I_T = I_1 + I_2 = 1 + 1.5 = 2.5A$$

Question 21 (c)

| Criteria | Marks |
|---|-------|
| • Uses correct formulae AND correct substitution of values | 3 |
| • Uses one correct formula AND correct substitution of values | 2 |
| • Uses one correct formula OR correct substitution of values | 1 |

Sample answer:

$$P_4 = I_2^2 R_4 = (1.5)^2 \times 4$$

$$= 2.25 \times 4$$

$$= 9W$$

Question 21 (d)

| Criteria | Marks |
|---|-------|
| <ul style="list-style-type: none">Identifies the correct readingDemonstrates a good understanding of the potential difference between branches | 3 |
| <ul style="list-style-type: none">Identifies the correct readingDemonstrates some understanding of the potential difference between branches | 2 |
| <ul style="list-style-type: none">Identifies the correct reading OR identifies a short circuit between branches | 1 |

Sample answer

Reading on \textcircled{G} will be 0A because of the short circuit between the two nodes which have the same voltage drop/ potential difference.

Answers could include:

Reading on \textcircled{G} will be 0A.

In a balanced bridge circuit, these two points have the same potential.

Section III

Question 22

| Criteria | Marks |
|---|-------|
| <ul style="list-style-type: none"> • Demonstrates a comprehensive understanding of the process of installation of recessed electrical components into a brick wall • Demonstrates a comprehensive understanding of the safety requirements to complete the task • Justifies an efficient procedure and the safety aspects in a logical and cohesive response | 13–15 |
| <ul style="list-style-type: none"> • Demonstrates a sound understanding of the process of installation of recessed electrical components into a brick wall • Demonstrates a sound understanding of the safety requirements to complete the task • Justifies the procedure and the safety aspects in a logical and cohesive response, may have some errors | 10–12 |
| <ul style="list-style-type: none"> • Demonstrates a sound understanding of the process of installation of recessed electrical components into a brick wall • Demonstrates a sound understanding of the safety requirements to complete the task • Outlines an efficient procedure and the safety aspects required to complete the task | 7–9 |
| <ul style="list-style-type: none"> • Demonstrates a basic understanding of the process of installation of recessed electrical components into a brick wall • Demonstrates a basic understanding of the safety requirements to complete the task • Outlines a procedure and the safety aspects required to complete the task | 4–6 |
| <ul style="list-style-type: none"> • Demonstrates a limited understanding of the process of installation of recessed electrical components into a brick wall OR a limited understanding of the safety requirements to complete the task | 1–3 |

Answers could include:

- Prepare a SWMS (safe work method statement) to carry out the procedure.
- To chase the wall you would mark out where the cut is to be made. Then install a diamond masonry blade in the angle grinder and check the tool lead for cuts and that the blade is tight.
- Wearing safety glasses, ear plugs and a dust mask make two cuts the width and depth of the conduit. Use a flat masonry chisel in a rotary hammer to chisel out the waste.
- Use a masonry drill bit to drill outline of socket box and chisel out waste.
- Fit conduit with clips and nyloc plugs and socket box with green plugs.

Section IV

Question 23 (a)

| Criteria | Marks |
|---|-------|
| <ul style="list-style-type: none"> • Demonstrates a comprehensive understanding of lighting system options available • Shows similarities and differences of the two systems with regard to suitability and efficiency • Writes a clear and cohesive response using industry terminology | 7 |
| <ul style="list-style-type: none"> • Demonstrates a sound understanding of lighting type options available • Shows similarities and differences of some aspects of the lighting types • Writes a clear and cohesive response using industry terminology • Provides a sound understanding of lighting systems available • Demonstrates an understanding of energy sources or lighting control | 5–6 |
| <ul style="list-style-type: none"> • Demonstrates a basic understanding of lighting system options available for the area | 3–4 |
| <ul style="list-style-type: none"> • Provides some relevant information | 1–2 |

Answers could include:

Lighting options could include:

- LED lighting:
 - Low power consumption good for reducing greenhouse gases, lower maintenance because of long life of chip
- Fluorescent tubes
 - Cheaper to purchase, good bulb life, ready availability of security fittings
- Flood lighting
 - Not as many fittings required, good lighting ability
 - Must be installed at height and shelters may cast a shadow
 - May work in BBQ area
 - Could be LED, Halogen or Mercury

Power supply:

- Power from mains supply
 - Need to check it is within load requirements of supply or whether an upgrade is needed
 - More economical to install and maintain
- Power from solar and battery storage
 - Higher initial cost
 - Concern of vandalism/theft
 - Long term more economical to run
 - Lighting Control (a combination of controls may be used)
 - PV panel, storage inverter and battery to be installed securely at an appropriate distance from lighting
 - Installation should consider ease of maintenance.

- Manual switch
 - Rocker switch
 - Could be left on using power when nobody is using area
 - Push button timer
 - Works well in limiting use of power
 - May be vandalised
- Timer
 - Can be programmed to only work in set hours
 - Could be left on using power when nobody is using area
- Light sensor
 - Operates in low light conditions
 - Could be left on using power when nobody is using area
- Motion sensor
 - Works well in limiting use of power
 - May have false activation by wind or animals
 - May be vandalised

Efficiency

- Power consumption
- Installation costs
- Running costs
- Lighting output

Question 23 (b)

| Criteria | Marks |
|--|-------|
| <ul style="list-style-type: none"> • Demonstrates a comprehensive understanding of the process to install the lighting system • Demonstrates a comprehensive understanding of the requirements to supply power to the installation, relevant to the electrotechnology industry | 8 |
| <ul style="list-style-type: none"> • Demonstrates a comprehensive understanding of the process to install the lighting system, relevant to the electrotechnology industry • Demonstrates a sound understanding of the requirements to supply power to the installation | 6–7 |
| <ul style="list-style-type: none"> • Demonstrates a sound understanding of the process to install the lighting system • Demonstrates a sound understanding of the requirements to supply power to the installation | 4–5 |
| <ul style="list-style-type: none"> • Demonstrates a basic understanding of the process to install the lighting system • Demonstrates a basic understanding of the requirements to supply power to the installation | 2–3 |
| <ul style="list-style-type: none"> • Identifies some relevant information in the installation of outdoor lighting | 1 |

Answers could include:

Work site establishment

- Safe Work Method Statements completed
- Coordinate access with park authorities/site induction
- Install barriers
- Signage displayed

Set out

- Set out any trench work
- Prepare trench work to eliminate the chance of vandalism during installation
- Install conduit and fittings

Rough in electrical

- Install cables
- Terminate fittings
- Testing and commission

Job completion

- Back fill trench to AS3000 specifications
- Site clean-up
- Complete testing report
- Site handover

2016 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 | Measuring and testing – page 42 | | | | | | | X | X |
| 2 | 1 | Safe work practices & procedures – page 54–55 | | | | | | | X | |
| 3 | 1 | Hand & power tools – page 31 | | | X | | | | X | |
| 4 | 1 | Safe work practices & procedures – page 55 | | | | | X | X | | |
| 5 | 1 | Hand & power tools – page 30 | | | | | | | X | |
| 6 | 1 | Series/parallel circuits – page 40 | | | | | | | | X |
| 7 | 1 | Electrical circuits (basic) – page 39 | | | | | | | | X |
| 8 | 1 | Series/parallel circuits – page 44 | | | X | | | | X | |
| 9 | 1 | Hand & power tools – page 31 | | | | | | | X | |
| 10 | 1 | Working with drawings diagrams, scheduling & manuals – page 48 | | | | | | | | X |
| 11 | 1 | Hand & power tools – page 30–31 | | | X | | | | X | |
| 12 | 1 | Environment – issues and sustainability, climate change – page 60 | | | | | X | | | X |
| 13 | 1 | Hand & power tools – page 30–31 | | | | | | | X | X |
| 14 | 1 | DC circuits – page 40 | | | X | | | | | X |
| 15 | 1 | Capacitance – page 43 | | | | | | | 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 | 4 | Sustainable energy – pages 60–61 | | | X | | | | | X |
| 17 (a) | 3 | Safe work practices & procedures – page 55 | X | | | | X | | | |
| 17 (b) | 3 | Safe work practices & procedures – page 55 | X | X | | | X | | | |
| 18 (a) | 2 | Safe work practices & procedures – page 36 | X | | X | | | X | | X |
| 18 (b) | 3 | Safe work practices & procedures – page 36 | X | | X | | | X | | X |
| 19 | 5 | Compliance – page 49 Energy sector worker – page 67 WHS compliance – page 53 | | X | X | | X | | | |
| 20 | 4 | Electrical drawings and diagrams – page 49 | | | X | | | | X | X |
| 21 (a) | 2 | Series/parallel circuits – page 40 | | | X | | | | X | |
| 21 (b) | 3 | Series/parallel circuits – page 40 | | | X | | | | X | |
| 21 (c) | 3 | Series/parallel circuits – page 40 | | | X | | | | X | |
| 21 (d) | 3 | Electrical circuit (basic) – page 39 | | | X | | | | X | |

Section III

| 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 | 15 | Fixing, securing and monitoring accessories – page 31 | | | 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 |
| 23 (a) | 7 | Sustainable energy – page 60–61 Compliance – page 50 | | | X | X | | | X | X |
| 23 (b) | 8 | Relationship to building construction work – page 49 Energy sector worker – page 69 | X | | | | X | X | | |