2019 HSC Metal and Engineering Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16 (a)

Criteria	Marks
• Correctly identifies the tool shown	1

Sample answer:

Hacksaw

Question 16 (b)

Criteria	Marks
• Outlines the process of fitting a new blade	2
• Identifies some relevant steps in fitting a new blade	1

Sample answer:

Select the appropriate blade. Place the new blade in position so that the teeth of the blade are pointing forwards, away from the handle. Most new blades have an arrow pointing in the forward direction. Tighten and adjust the nut to the correct tension.

Question 16 (c) (i)

Criteria	Marks
• Clearly justifies the choice of blade	2
• Identifies the most suitable blade • Provides some relevant justification	1

Sample answer:

18 tpi (teeth per 25 mm) would be ideal for efficiently cutting soft thick materials such as mild steel. The gap between the teeth is larger, allowing for plenty of chip clearance. This enables more material to be quickly removed per stroke, without clogging the blade.

Question 16 (c) (ii)

Criteria	Marks
• Demonstrates a clear understanding of the correct way to use the hand tool to remove the waste material	3
• Demonstrates some understanding of the correct way to use the hand tool to remove the waste material	2
• Demonstrates limited understanding of the correct way to use the hand tool to remove the waste material	1

Sample answer:

Secure work piece in vice. Hold tool correctly by placing one hand on the handle (pistol grip) and the other hand on the frame. Cut on forward stroke at rate of one second per stroke. Lift blade slightly on back stroke. Rotate block in vice. Secure. Make final cut to remove waste.

Question 17 (a)

Criteria	Marks
• Correctly identifies ITEM 4	1

Sample answer:

Gusset.

Question 17 (b)

Criteria	Marks
• Provides correct height and working	2
• Provides correct height with inaccurate working OR • Provides incorrect height with some correct working OR • Provides correct height with no working	1

Sample answer:

(ITEM 2) 98 mm long + (ITEM 1) 12 mm thick = overall height 110 mm.

Question 17 (c)

Criteria	Marks
• Provides a comprehensive description of the benefits of using orthogonal drawings over using pictorial drawings	4
• Provides a sound description of the benefits of using orthogonal drawings over using pictorial drawings	3
• Provides some description of the benefits of using orthogonal drawings and/or pictorial drawings	2
• Provides some relevant information	1

Sample answer:

Orthogonal drawings form the basis of working drawings: orthogonal drawings show an object in two dimensions and usually show multiple views of the object. The views are in order depending on their angle of projection. Two-dimensional drawings allow the manufacturer to have a clear view and understanding of the details and dimensions required to manufacture the component. Pictorial drawings are three-dimensional and are not necessarily true length.

Question 17 (d)

Criteria	Marks
• Provides all the steps required, in a logical sequence, to mark out and manufacture ITEM 1 • Provides all of the tools required	6
• Provides most of the steps required to mark out and manufacture ITEM 1 • Provides most of the tools required	5
• Provides some appropriate steps to make out and/or manufacture the item • Provides some of the tools required	4
• Lists some steps to make out and/or to manufacture the item and/or some of the tools required	2–3
• Provides some relevant information	1

Sample answer:

Sequence of steps – marking out	*Tools required*
Collect piece of 90 mm × 12 mm flat bar Check datum end is square 90 degrees From datum, mark 160 mm long Mark a square line at the 160 mm mark From the datum, mark 25 mm Mark a square line on the 25 mm mark From each side of the flat bar mark 22 mm on the 25 mm line Centre punch where the lines intersect	Steel rule Scriber Engineer's square Centre punch Engineer's hammer
Sequence of steps – manufacturing	*Tools required*
Collect marked out piece of flat bar Cut to length Hold work piece firmly in the drill vice Using a 10 mm drill bit in a pedestal drill, drill both holes Remove all sharp edges	Cold saw Hack saw Drill vice Pedestal drill File

Question 18

Criteria	Marks
• Provides a comprehensive explanation of how zeroing and test pieces are used to validate measuring devices • Provides relevant examples	4
• Provides a sound explanation of how zeroing and test pieces are used to validate measuring devices • Provides examples	3
• Provides a limited explanation of how zeroing and test pieces are used to validate measuring devices • May provide examples	2
• Provides some relevant information	1

Sample answer:

When using a digital vernier caliper it needs to be ‘zeroed’ every time it is turned on. This is because it may be moved while in the off position which would provide incorrect measurements when it is turned on. A test piece, which has an exact/precision length which is known, can be used to measure the accuracy of the calibration of the micrometer. If the micrometer readings do not match the length of the test piece, the micrometer can be adjusted until the calibration is correct.

Question 19 (a)

Criteria	Marks
• Provides a detailed description of the process of reporting faults in power tools	4
• Provides a description of the process of reporting faults in power tools	3
• Provides main features of reporting faults in power tools	2
• Provides some relevant information about reporting faults in power tools	1

Sample answer:

Once a serious fault has been identified in a power tool the worker in the metal and engineering industry needs to notify their supervisor immediately. This is commonly done verbally in the first instance. Once the supervisor is notified a formal recording needs to be done on a job card or a maintenance log. This ensures that the power tool is repaired. A safety lockout needs to be applied to the power tool to ensure no one uses the tool until it is repaired.

Question 19 (b)

Criteria	Marks
• Provides a description of TWO different indicators of poor performance and inefficiency in power tools • Provides specific example for each indicator	6
• Provides a description of an indicator of poor performance and inefficiency in power tools • Outlines another indicator of poor performance and inefficiency in power tools • Provides an example for each indicator	4–5
• Outlines TWO indicators of poor performance and inefficiency in power tools • Provides examples	3
• Outlines ONE indicator of poor performance and inefficiency in power tools • Provides an example	2
• Provides some relevant information	1

Answers could include:

- Excessive noise
  - Worn bearing
  - Loose/damaged casing
  - Loose guard
  - Incorrect cutting speed
  - Incorrect cutting fluid
- Vibration
  - Poorly fitted blades/disc/cutting tool
  - Bent component
  - Loose guard
  - Worn bearing
- Failing to start
  - Flat battery
  - Damaged cord/plug
  - Faulty tool
  - Incorrect fuel
- Quality of end product
  - Incorrect cutting tool fitted
  - Poor sharpening of cutting tool
  - Incorrect speed
  - Incorrect speed setting
  - Damaged gearbox.

Section III

Question 20

Criteria	Marks
• Demonstrates a comprehensive understanding of the strategies a company uses to ensure work progresses such as staff shortages, damaged tools and equipment and inadequate training • Provides a logical and cohesive response, using relevant workplace examples and precise industry terminology	13–15
• Demonstrates a sound understanding of the strategies a company uses to ensure work progresses such as staff shortages, damaged tools and equipment and inadequate training • Provides a clear and organised response, using relevant workplace examples and precise industry terminology	10–12
• Demonstrates an understanding of the strategies a company uses to ensure work progresses such as staff shortages, damaged tools and equipment and inadequate training • Uses general industry terminology and/or relevant workplace examples	7–9
• Demonstrates an understanding of the strategies a company uses such as staff shortages and/or damaged tools and equipment and/or inadequate training	4–6
• Provides limited information relating to strategies a company uses such as staff shortages and/or damaged tools and equipment and/or inadequate training	1–3

Answers could include:

- Staff shortages can occur in a company due to staff leaving, getting sick or on leave. To ensure that work requirements are met staff shortages can be solved by hiring temporary staff through an industry recruitment agency. The recruitment agency can be briefed to ensure that they direct appropriately trained and licensed personnel in the metal and engineering industry to the company. The hiring of staff can be short term or long term depending on requirements.
- Damaged tools and equipment have significant effects on work project management. Damaged tools and equipment need to be repaired as soon as possible. To ensure this occurs a company needs to have developed good relationships with repair companies in this field, so that they can fix any issues quickly.
- Lack of training. If it is identified that staff lack training this can affect project management. Companies need a strategy of both formal and informal support in training inhouse or at a TAFE in areas that are required. Informal support could include a mentor system where experienced staff could assist younger staff in developing areas that are lacking.

Section IV

Question 21 (a)

Criteria	Marks
• Demonstrates a comprehensive understanding of sustainability and how it relates to the industry	5
• Demonstrates a sound understanding of sustainability and how it relates to the industry	3–4
• Provides a basic understanding of sustainability and its importance to the industry	2
• Provides some relevant information about sustainability	1

Sample answer:

Sustainability is the management and preservation of natural resources.

The metal and engineering industry has a moral, ethical and in some cases a legal responsibility to develop and incorporate sustainable practices during the production of goods.

All natural materials are obtained from the earth's surface or just below its surface and are a finite resource. Ores are mined and then processed in various ways to produce metal and other products. Extracting ores harms the environment through mining. Production of metal also leads to the extraction and use of other natural resources such as firewood and coal.

The metal and engineering industry should be able to manage natural resources so that it will remain viable and not exhaust materials. In this way materials will be available for much longer and allow future generations to meet their own needs.

Good sustainable industry practices are essential to sustain and maintain an industry and its resources. This will enable the industry to be economically prosperous and minimise negative environmental impacts.

Question 21 (b)

Criteria	Marks
• Explains in detail strategies that can be employed by a metal and engineering company to incorporate and maintain sustainable practices	9–10
• Explains some strategies that can be employed by a metal and engineering company to incorporate and maintain sustainable practices	7–8
• Describes some strategies that can be employed by a metal and engineering company to incorporate and/or maintain sustainable practices	5–6
• Outlines some strategies that can be employed by a metal and engineering company to incorporate and/or maintain sustainable practices	3–4
• Provides some information about sustainable practices	1–2

Answers could include:

Good sustainable practices can be considered in the initial stages of the design of a product.

- Good design leads to an efficient product that minimises waste. Alternative manufactured materials such as plastics can also be considered.
- Production and engineering drawings should be properly read and interpreted by manufacturers, supervisors and tradespeople. This will lead to correct work practices and down time will be reduced and production maximised. Tradespeople should double check measurements before commencing production: measure twice and cut once. There should be clear communication between supervisors and tradespeople. All workers should check with their supervisors to clarify instructions.
- Pre-plan how much material is required to maintain production and don't over order. Only order the materials that will be required for each current project or goods. Also where possible, lengths can be purchased pre-cut to exact lengths from the supplier. This will again minimise waste and save on tooling costs. Full lengths of material should be stored in racks and easily accessible.
- Try to minimise material wastage. Do not use standard lengths every time material is required. Offcuts and smaller available lengths should be used when available. Adequate storage facilities should be available so that shorter lengths and offcuts are readily available. This can be achieved by having them in their own storage area and having bins to place shorter similar lengths. Where possible, recycled materials from other dismantled work should be used.
- Do not throw away waste materials. Store and send away all waste metal to recyclers. Don't mix different types of metals. Store all copper together in one bin, aluminium in a separate bin and so on. Recyclers pay a higher rate for metal that is not mixed. Recycling metal will reduce landfill accumulation.
- When metal is produced it creates toxic fumes and waste products which are bad for the environment. Recycling metal minimises these toxic by-products and minimises environmental damage. Recycled metal can also be cheaper and more cost effective.
- Production techniques and quality checks should be used at all stages of manufacture. These can include Quality Control techniques such as nesting. Nesting is a process of regularly checking items that are mass produced to ensure quality is being maintained. In this way Quality Assurance of the finished product will be maintained and there will be no wastage. Improvements in tooling and machines such as CNC lathes have led to more efficient production.
- Companies should filter all extracted air and reuse and recycle oils and coolants through filtering. They should also only deal with companies and suppliers that incorporate sustainable practices.

2019 HSC Metal and Engineering
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	MEM16007A Work with others in a manufacturing, engineering or related environment — element 2 – page 73	X							
2	1	MEM15024A Apply quality procedures — element 1 – page 66					X		X	
3	1	MEM18001C Use hand tools — element 1.1 – page 83								X
4	1	MEM13014A Apply principles of occupational health and safety in the work environment — element 1 – page 39					X	X		
5	1	MEM09002B Interpret technical drawing — element 1 – page 18	X							
6	1	MEM12023A Perform engineering measurements — element 1 – page 24			X					
7	1	MEM09002B Interpret technical drawing — element 1 – page 18	X			X				
8	1	MEM12024A Perform computations — element 1 – page 32							X	
9	1	MEM09002B Interpret technical drawing — element 1 – page 19			X					
10	1	MEM12023A Perform engineering measurements — element 1 – page 24								X
11	1	MEM15002A Apply quality systems — element 1 – page 60		X						
12	1	MEM15002A Apply quality systems — element 1 – page 60					X			
13	1	MEM18002B Use power tools/hand held operations — element 1 – page 89								X
14	1	MEM12023A Perform engineering measurements — element 1 – page 24	X						X	X
15	1	MEM12024A Perform computations — element 1 – page 32			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)	1	MEM18001C Use hand tools — element 1 – page 83							X	
16 (b)	2	MEM18001C Use hand tools — element 1 – page 83					X			
16 (c) (i)	2	MEM18001C Use hand tools — element 1 – page 83			X					
16 (c) (ii)	3	MEM14004A Plan to undertake a routine task — element 1 – page 54								X
17 (a)	1	MEM09002B Interpret technical drawing — element 1 – page 19	X							
17 (b)	2	MEM12024A Perform computations — element 1 – page 32			X					
17 (c)	4	MEM09002B Interpret technical drawing — element 1 – page 17	X	X						
17 (d)	6	MEM14004A Plan to undertake a routine task — element 1 – page 54						X		
18	4	MEM12023A Perform engineering measurements — element 3 – page 26				X				
19 (a)	4	MEM13014A Apply principles of OHS — element 1.5 – page 43						X		
19 (b)	6	MEM18002B Use power tools/hand held operations — element 1 – page 91	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
	15	MEM14004A Plan to undertake a routine task — element 2 – page 55 MEM16007A Work with others in a manufacturing, engineering or related environment — element 3 – page 79	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
21 (a)	5	Manufacturing, engineering and related industries induction — element 4 – page 14					X	X	X	
21 (b)	10	Manufacturing, engineering and related industries induction — element 4 – page 14	X	X	X	X				X