

2024 HSC Automotive Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16

Criteria	Marks
<ul style="list-style-type: none"> Provides a sound description of the steps the workshop manager can take to manage this situation 	3
<ul style="list-style-type: none"> Provides some description of the steps the workshop manager can take to manage this situation 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

The manager can speak to the apprentice to discuss their concerns and check on the apprentice's wellbeing.

The manager will need to speak to the technicians to address their behaviour and enforce the workplace bullying and harassment policies.

If the behaviour continues, the manager may need to take formal disciplinary action.

Question 17

Criteria	Marks
<ul style="list-style-type: none"> Demonstrates a thorough understanding of how the risk control hierarchy can be used to manage the risks associated with removing an engine from a vehicle using an engine crane 	4
<ul style="list-style-type: none"> Demonstrates a sound understanding of how the risk control hierarchy can be used to manage the risks associated with removing an engine from a vehicle using an engine crane 	3
<ul style="list-style-type: none"> Demonstrates some understanding of how the risk control hierarchy can be used to manage the risks associated with removing an engine from a vehicle using an engine crane 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

The technician would carry out a risk assessment to identify any potential hazards. Based on the risk assessment the technician can then determine if the hazards can be eliminated. If the hazards cannot be eliminated the technician can determine what safety measures need to be used. For example, ensuring the engine crane and lifting equipment are in working order and the SWL is suitable for the engine removal.

The technician must also ensure they know how to use the equipment and that the correct PPE is worn.

Question 18 (a)

Criteria	Marks
<ul style="list-style-type: none"> • Outlines THREE safety precautions associated with inspecting a vehicle's braking system 	3
<ul style="list-style-type: none"> • Provides some outline of safety precautions associated with inspecting a vehicle's braking system 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

Three safety precautions associated with inspecting a vehicle's braking system include:

- Wearing a face mask to avoid brake dust as the airborne particles may contain asbestos
- Checking the brake temperature carefully as the brakes may be hot if the vehicle was recently driven
- Wearing the correct PPE.

Question 18 (b)

Criteria	Marks
<ul style="list-style-type: none"> • Provides a sound explanation of how rear brake pads are replaced on a vehicle fitted with an electric handbrake 	3
<ul style="list-style-type: none"> • Outlines how rear brake pads are replaced on a vehicle fitted with an electric handbrake 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

To replace the rear brake pads on a vehicle fitted with an electric handbrake, the technician needs to connect a scan tool and place the rear brake calipers into service mode. This will allow the technician to wind the caliper pistons back.

The technician then has to remove the caliper and wind the brake pistons back. The brake pads are then replaced and the calipers re-fitted, the caliper slides are lubricated and mounting bolts torqued.

The technician then uses the scan tool to reset the electric handbrake.

Question 19

Criteria	Marks
<ul style="list-style-type: none"> Provides a thorough explanation of how teamwork can affect productivity in an automotive workshop 	4
<ul style="list-style-type: none"> Provides a sound explanation of how teamwork can affect productivity in an automotive workshop 	3
<ul style="list-style-type: none"> Demonstrates some understanding of teamwork and/or productivity in an automotive workshop 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Teamwork helps technicians complete work tasks and diagnose vehicles. Teamwork also creates a positive working environment in which employees feel valued and supported. Teamwork will also add to efficiencies in diagnosis (collective knowledge). A lack of teamwork can lead to a lack of productivity and a poor working environment.

Question 20 (a)

Criteria	Marks
<ul style="list-style-type: none"> Outlines a process to troubleshoot the fault 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

To troubleshoot the fault a technician could ask the customer some questions to get more information relating to the problem, for example, 'when does the vibration occur?' The technician could also test drive the vehicle.

Question 20 (b)

Criteria	Marks
• Provides a comprehensive explanation of possible causes of an engine overheating	5
• Provides a thorough explanation of possible causes of an engine overheating	4
• Demonstrates a sound understanding of possible causes of an engine overheating	3
• Demonstrates some understanding of possible causes of an engine overheating	2
• Provides some relevant information	1

Sample answer:

There may be several causes of an engine overheating without coolant loss.

The thermostat regulates coolant flow through the radiator. If the thermostat was stuck closed, then there would be insufficient coolant flow through the radiator to cool the engine. Another cause of overheating may be a faulty engine cooling fan. If the fan is belt-driven a slipping fan belt would not allow the fan to cool the radiator. A faulty viscous coupling or electric fan would also not cool the radiator causing overheating.

Answers could include:

A blown head gasket may be another cause of engine overheating. Combustion gases entering the cooling system would cause the engine to overheat due to their high temperatures.

Question 21 (a)

Criteria	Marks
• Correctly calculates the current flow in the coolant temperature sensor circuit using Ohm's law	2
• Provides some relevant information	1

Sample answer:

Volts (V) = 8

Resistance (R) = 40

$$V = IR$$

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

$$I = \frac{8}{40}$$

$$I = 0.2 \text{ A}$$

Question 21 (b)

Criteria	Marks
• Identifies the steps of the soldering process to repair the wiring harness	3
• Identifies some steps of the soldering process to repair the wiring harness	2
• Provides some relevant information	1

Sample answer:

- Strip back the insulation of the wires and fit heatshrink over the wires
- Join the wires by twisting together
- Heat the soldering iron, clean and tin the tip of the soldering iron
- Using the soldering iron, heat the wires and apply the solder
- Once the wire has cooled slide the heat shrink over the wires and shrink using a heat gun to insulate the joint.

Question 21 (c)

Criteria	Marks
• Demonstrates a comprehensive understanding of the tests a technician could perform to test the oxygen sensor heater	6
• Demonstrates a thorough understanding of the tests a technician could perform to test the oxygen sensor heater	5
• Demonstrates a sound understanding of the tests a technician could perform to test the oxygen sensor heater	3–4
• Demonstrates some understanding of the tests a technician could perform to test the oxygen sensor heater	2
• Provides some relevant information	1

Sample answer:

- The technician could disconnect the sensor from the circuit and test the resistance of the heater using a multimeter
- The technician could test the resistance of the heater at point *A* and point *B*. If the sensor is working correctly, the resistance should be 15 ohms. If the resistance is too high, it would mean that the heater is possibly damaged or has an open circuit. If the reading is too low, it could possibly mean that the heater has short circuited
- The technician could also check for battery voltage at point *A* using a multimeter
- The technician could check for continuity between point *B* and point *C* to check the connection between the heated oxygen sensor and the electronic control unit.

Section III

Question 22 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides a comprehensive description of the tests a technician could perform to identify faults in the charging system 	5
<ul style="list-style-type: none"> Provides a thorough description of the tests a technician could perform to identify faults in the charging system 	4
<ul style="list-style-type: none"> Provides a sound description of the tests a technician could perform to identify faults in the charging system 	3
<ul style="list-style-type: none"> Demonstrates some understanding of tests a technician could perform to identify faults in the charging system 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

To test the output of the alternator, the technician can carry out a load test on the charging system. Using a multimeter across the battery and running the engine at approximately 2500 rpm, the technician should see a charging voltage of approximately 14 volts. A low charge voltage would indicate a fault with the charging system.

To identify the fault in the charging system, the technician could check the drive belt condition and tension to ensure that the drive belt isn't slipping. The technician could also carry out a battery test to ensure it is in good condition as well as checking that the battery terminals are clean and secure. The technician could check that all wiring connectors are secure and using a multimeter, carry out a voltage drop test on the positive and negative alternator circuits. This would identify any connections that may have a high resistance.

Scan tools can be used to identify faults in late model smart charging systems. Scan tools can be used to perform tests on the charging system such as a maximum current output tests.

Question 22 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides a comprehensive explanation of how the engine management system manages fuel delivery to maximise engine efficiency and engine performance 	9–10
<ul style="list-style-type: none"> Provides a thorough explanation of how the engine management system manages fuel delivery to maximise engine efficiency and engine performance 	7–8
<ul style="list-style-type: none"> Provides a sound explanation of how the engine management system manages fuel delivery to maximise engine efficiency and engine performance 	5–6
<ul style="list-style-type: none"> Provides some understanding of how the engine management system manages fuel delivery to maximise engine efficiency and engine performance 	3–4
<ul style="list-style-type: none"> Provides some relevant information 	1–2

Answers could include:

The engine management system maximises fuel efficiency and engine performance, by monitoring all related sensors associated with the engine.

- The engine coolant temperature sensor
- the air intake temperature sensor
- the air flow sensor
- the manifold absolute pressure
- the boost pressure sensor (if applicable)
- The throttle position switch

It also looks at the engine load placed upon it. The ECU then supplies the correct signal to the fuel injectors and ignition timing curve to maximise fuel efficiency and engine performance.

Section IV

Question 23

Criteria	Marks
<ul style="list-style-type: none"> Provides a comprehensive explanation on how the automotive industry is adapting to the challenges in technology whilst maintaining environmentally sustainable practices Provides a logical and cohesive response Effectively integrates relevant workplace examples and industry terminology 	13–15
<ul style="list-style-type: none"> Provides a thorough explanation on how the automotive industry is adapting to the challenges in technology whilst maintaining environmentally sustainable practices Provides a cohesive response Uses relevant workplace examples and industry terminology 	10–12
<ul style="list-style-type: none"> Provides a sound explanation on how the automotive industry is adapting to the challenges in technology whilst maintaining environmentally sustainable practices Provides a structured response Uses some industry terminology and workplace examples 	7–9
<ul style="list-style-type: none"> Demonstrates some understanding on how the automotive industry is adapting to the challenges in technology whilst maintaining environmentally sustainable practices Provides a clear response Uses basic industry terminology and/or workplace examples 	4–6
<ul style="list-style-type: none"> Provides some relevant information 	1–3

Answers could include:

Australia’s growing demand for electric vehicles (EVs) has created significant challenges that the automotive industry has to adapt to whilst maintaining environmentally sustainable practices.

- Increased demand for EVs leads to higher extraction of raw materials such as lithium and cobalt which are key elements in lithium-ion batteries. This mining can also result in habitat destruction due to environmental degradation from contamination from mining practices. The automotive industry has responsibility to sustainably source these materials eg recycled materials.
- The disposal of used electric vehicle batteries poses a significant environmental challenge. Recycling of lithium-ion batteries is a complex process that requires large amounts of energy. Technology is being developed to make this process simpler to reduce the amount of battery waste.
- The increased need for EV charging stations has environmental impacts as a large number of charging stations are required to service EV vehicles. This is due to the time it takes to charge an EV battery. In time these charging stations will replace both service stations and the need for fossil fuels. Vehicle workshops will also need to install EV charging stations to work on vehicles.

- The growing demand for EVs will also have an impact on automotive workshops. Workshops will need dedicated EV work bays as well as an area to store EV parts and batteries. This will lead to workshops requiring more workshop floor space as well as a dedicated space for EV emergencies such as a battery fire.
- The risk of fires from EV batteries will also have environmental implications. Due to the risk of battery fires specific areas will be required for EV charging. This will impact building development and existing infrastructure.
- The increased number of EVs will lead to a reduction in workshop waste from example waste engine oil and filters as EVs do not require this type of servicing.
- This technology will require new tools for EV servicing and repairs. This includes diagnostic equipment.
- New PPE will be required for technicians to work on EVs.
- Government regulations will require technicians to be qualified prior to work on EVs. This will produce an increasing demand for training and certification.

2024 HSC Automotive Mapping Grid

Section I

Question	Marks	HSC content – focus area
1	1	Working in the industry – maintenance and storage of automotive tools and equipment – page 47
2	1	Working in the industry – maintenance and storage of automotive tools and equipment – page 46
3	1	Working in the industry – operation of automotive tools and equipment – page 46
4	1	Safety – safe work procedures and practices – page 27
5	1	Working in the industry – work practices – page 44
6	1	Automotive systems and components – vehicle mechanical systems and components – page 22
7	1	Working in the industry – nature of the industry – page 41
8	1	Automotive systems and components – electrical fundamentals – page 24
9	1	Working in the industry – Automotive tools and equipment – page 46
10	1	Automotive systems and components – principals of operation – page 22
11	1	Sustainability – environmentally sustainable work practices – page 34
12	1	Automotive systems and components – vehicle electrical systems and components – page 24
13	1	Automotive systems and components – principals of operation – page 22
14	1	Working in the industry – automotive tools and equipment – page 46
15	1	Working in the industry – automotive tools and equipment – page 46

Section II

Question	Marks	HSC content – focus area
16	3	Working in the industry – employment – page 43
17	4	Safety – risk management – page 29
18 (a)	3	Safety – risk management – page 29
18 (b)	3	Working in the industry – technology – page 45
19	4	Working in the industry – working with others – page 45
20 (a)	2	Troubleshooting and problem-solving – troubleshooting processes – page 37
20 (b)	5	Troubleshooting and problem-solving – trouble shooting processes – page 37
21 (a)	2	Automotive systems and components – electrical fundamentals – page 24
21 (b)	3	Automotive systems and components – testing electrical circuits, wiring and components – page 25
21 (c)	6	Automotive systems and components – testing electrical circuits, wiring systems and components – page 25

Section III

Question	Marks	HSC content – focus area
22 (a)	5	Troubleshooting and problem-solving – troubleshooting process – page 37

Question	Marks	HSC content – focus area
22 (b)	10	Automotive systems and components – vehicle mechanical systems and components – page 21

Section IV

Question	Marks	HSC content – focus area
23	15	Sustainability – environmental issues and sustainability – page 33 Working in the industry – technology – page 45