BOARD OF STUDIES
NEW SOUTH WALES

2013 HSC Automotive Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16 (a)

Criteria	Marks
• Outlines an accurate and logical procedure for locating the cause and location of the fluid leak using the correct tools and industry practice	3
• Outlines with some accuracy a procedure for locating the cause and location of the fluid leak	2
• Provides part of a procedure used to identify the cause and location of the leak	1

Sample answer:

Wheels should be jacked up and supported on jack stands or on a vehicle hoist. Using a suitable light inspect the area of the leak and try to determine the type of fluid. This may be done by looking at the colour, texture, thickness and smell. Once the leak has been found tests should be completed to confirm the area or location of the leak. For example a radiator pressure tester can be used to confirm a coolant leak.

Question 16 (b)

Criteria	Marks
• Outlines an appropriate procedure for battery and electrical system testing which are relevant to the scenario • Identifies all tools and equipment needed	5
• Outlines a suitable procedure for battery and electrical system testing • Identifies a range of tools and equipment needed	2–4
• Outlines a basic procedure for battery and electrical system testing • Identifies some of the tools and equipment needed	1

Sample answer:

Test the battery voltage using a multimeter. A fully charged battery should be 12.6 volts. Check the alternator voltage at the battery using a multimeter. When the engine is running it should be above 14 volts. Check the alternator output voltage and amperage directly at the alternator with an ammeter. Also check voltage drop from the alternator to the battery. Check for voltage drop from the headlights to the battery on both the power supply and earth connections. A voltage drop from the headlight connections to the battery may indicate a faulty headlight relay or switch, a bad earth connection, faulty connectors in the circuit, loose wires or connections. Remove headlight globe without touching the glass and check its condition. May be tested using a known good headlight to confirm if required.

Question 17 (a)

Criteria	Marks
• Correctly names the three suspension spring designs	2
• Correctly names two of the three suspension spring designs	1

Sample answer:

(i) Torsion bar
(ii) Leaf spring
(iii) Coil spring

Question 17 (b)

Criteria	Marks
• Provides an accurate description of how a shock absorber works • Uses industry specific terminology	3
• Provides a general description of how a shock absorber works • Uses industry terminology	2
• Provides a limited description of how a shock absorber works • Uses general terms	1

Sample answer:

Shock absorbers normally contain hydraulic oil that's transferred from one end to the other through small orifices as the shock moves up and down. The size of the holes in the orifices determines how fast the shock moves up and down. This results in a damping effect and reduces oscillations, which improves drivability and passenger/driver comfort.

Question 18 (a)

Criteria	Marks
• Correctly names pillar	1

Sample answer:

B pillar

Question 18 (b)

Criteria	Marks
• Outlines a range of benefits of this body design • Provides a comprehensive response using industry specific terminology	3
• Outlines benefits of this body design • Provides a relevant response using some industry terminology	2
• Outlines basic benefits of this body design • Uses limited or generalised industry terminology	1

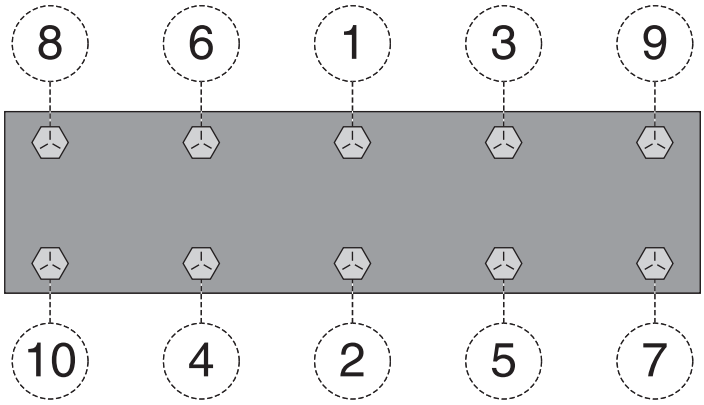
Sample answer:

The monocoque or uni-body design provides excellent strength which includes different high strength materials which are used as crumple zones. This provides improved safety for the vehicle occupants. Further, the uni-body design allows for greater cabin space, even though the overall vehicle size may be smaller. They are typically lighter in construction, which also contributes to improved fuel economy and emissions.

Question 19 (a)

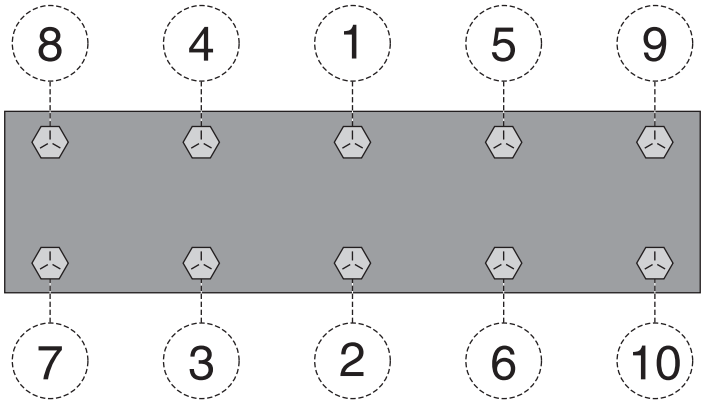
Criteria	Marks
• All bolts numbered correctly in one of the two following sequences	1

Answers could include:



Sequence 1

Or



Sequence 2

Question 19 (b)

Criteria	Marks
• Correctly names the tool and its purpose	2
• Correctly states either the name or purpose of the tool	1

Sample answer:

Tool shown is an angle gauge. It is used to tighten cylinder head bolts to a set angle, after the bolts have been pre-tensioned.

Question 19 (c)

Criteria	Marks
• Describes a comprehensive procedure for installing a cylinder head • Clearly identifies an appropriate range of tools and equipment needed • Uses industry specific terminology	4
• Outlines a detailed procedure for installing a cylinder head • Identifies a range of tools and equipment needed • Provides a logical response using appropriate industry terminology	3
• Outlines a sound procedure for installing a cylinder head • Identifies a limited range of tools and equipment needed • Provides a basic response using basic industry terminology	2
• Outlines a basic procedure for installing a cylinder head OR • Identifies a limited range of tools and equipment needed	1

Sample answer:

Cylinder head should be completely clean and have all oil and old pieces of gaskets removed. Ensure the replacement head gasket is clean and also is the correct gasket for the engine. Ensure all boltholes in the block are clean and the block surface is flat and clean of oil and old gaskets. Clean the head bolt threads. Fit head gasket and place cylinder head onto engine block. Be careful not to mark or scratch the cylinder head. Cylinder head should sit flat on the block. Install cylinder head bolts and tighten in the manufacturer's recommended order. Tension to the specifications given using a torque wrench and/or angle gauge.

Question 20 (a)

Criteria	Marks
• Correctly identifies all 4–5 components	3
• Correctly identifies 3 components	2
• Correctly identifies 2 components	1

Sample answer:

A Heater core
B Thermostat housing/thermostat
C Radiator cap
D Transmission oil cooler/radiator tank
E Header tank/overflow bottle/expansion tank

Question 20 (b)

Criteria	Marks
• Provides a comprehensive explanation of the operation of the cooling system	4
• Provides a sound explanation of the operation of the cooling system	3
• Provides a limited explanation of the operation of the cooling system	2
• Provides a relevant point about the operation of the cooling system	1

Sample answer:

The cooling system operates by circulating coolant around the engine to remove heat generated during the combustion process. The heated coolant is circulated by the water pump from the engine to the radiator. The radiator removes the heat via radiation by the air passing over the radiator. When the engine is cold a thermostat closes off the flow of coolant to the radiator allowing the engine to warm up more quickly to reduce fuel consumption. When the engine is warm the thermostat opens allowing coolant to flow through the radiator to be cooled. Coolant circulates through the radiator hoses, heater hoses and heater core as required. A header tank is sometimes used to allow air to bleed to the highest point to prevent overheating, cracked cylinder heads and airlocks. A radiator pressure cap is also used to raise the boiling point of the coolant.

Question 21

Criteria	Marks
• Demonstrates a detailed understanding of why vehicles in an automotive workshop are washed in an approved wash bay • Provides a sound description of how a wash bay should be designed	4
• Demonstrates a sound understanding of why vehicles in an automotive workshop are washed in an approved wash bay • Provides a description of how a wash bay should be designed	3
• Demonstrates a limited understanding of why vehicles in an automotive workshop are washed in an approved wash bay • Provides a limited description of how a wash bay should be designed	2
• Demonstrates a basic understanding of why vehicles in an automotive workshop are washed in an approved wash bay	1

Sample answer:

All activities conducted in a commercial workshop result in trade waste water. The EPA requires that all trade waste water be treated prior to discharging into the sewer system. This results in all vehicles having to be washed in an approved wash bay.

Wash bay should have an impervious / waterproof floor and be covered by a roof. The wash bay area should be suitably bunded to channel water into a pre-treatment system, prior to it being discharged into the sewer.

Section III

Question 22

Criteria	Marks
• Describes an extensive range of driveline configurations • Demonstrates a comprehensive understanding of how various driveline systems contribute to vehicle efficiency • Communicates ideas in a well-reasoned, cohesive response • Uses precise industry terminology with examples to support the link between driveline configurations and vehicle efficiency	13–15
• Describes a broad range of driveline configurations • Demonstrates a detailed understanding of how various driveline systems contribute to vehicle efficiency • Communicates ideas and information in a logical response • Uses appropriate industry terminology with some examples that support the link between driveline configurations and vehicle efficiency	10–12
• Identifies a range of driveline configurations • Demonstrates a sound understanding of how various driveline systems contribute to vehicle efficiency • Communicates ideas and information in a sound response • Uses appropriate industry terminology	7–9
• Provides examples of driveline configurations • Demonstrates a basic understanding of how various driveline systems contribute to vehicle efficiency • Communicates some ideas and information • Uses basic industry terminology	4–6
• Demonstrates a limited understanding of how driveline configurations contribute to vehicle efficiency • Uses limited industry terminology	1–3

Answers could include:

Configurations:

- Front wheel drive
- Rear wheel drive
- Mid engine / rear engine
- Electric or hybrid (driveline)
- All-wheel drive
- Four wheel drive
- Front engine / rear gearbox / axle

Rear Wheel Drive

- North south engine layout — manual or automatic transmission at front of vehicle — final drive at rear with live or independent suspension
- This system of transmission was the most common but is now not used by many manufacturers
- Still preferred for towing — not efficient due to extra mass / rotating mass and intrusion of interior space

All or Four Wheel Drive

- North south or east west engine layout — manual / automatic trans with transfer case to allow drive shaft to front / rear final drive
- This system is not efficient fuel wise but is efficient for towing — launching boats etc

Front Wheel Drive

- Most used layout is east west with compact transmissions driving front wheels
- Low rotating mass — not intruding into interior space most efficient use of materials / space

Other efficient transmissions

- C.V.T. Constant Variable Transmissions.
- D.C.T. Double Clutch Transmissions
- Have many ratios and less loss than hydraulic auto transmissions

Section IV

Question 23 (a)

Criteria	Marks
• Provides a detailed description of the features of the systems that contribute to improved fuel efficiency and reduced emissions • Uses appropriate industry terminology	4–5
• Provides a sound description of the features of the systems that contribute to improved fuel efficiency and reduced emissions • Uses some appropriate industry terminology	2–3
• Provides a basic description of the features of the systems • Provides general information	1

Sample answer:

The engine utilises an engine management system with positioning sensors that relay information to engine ECU. The ECU can then control ignition timing – fuel injection timing and emission control devices. This management system also has variable valve timing on the inlet camshaft.

This engine also has a catalytic converter which reduces the harmful gases leaving the exhaust. The engine design has multi valve cylinder head with an double overhead camshaft which also improves efficiency and performance.

Question 23 (b)

Criteria	Marks
• Demonstrates a comprehensive understanding of how technology is used by manufacturers, with clear examples • Clearly links how the technology has been used to achieve fuel efficiency and a reduction in harmful emissions • Communicates ideas and information in a well reasoned cohesive response • Correctly uses precise industry terminology	8–10
• Demonstrates a sound understanding of how technology is used by manufacturers, with examples • Links how the technology has been used to achieve fuel efficiency and a reduction in harmful emissions • Communicates ideas and information in a logical response • Uses appropriate industry terminology	6–7
• Demonstrates an understanding of how technology is used by manufacturers, with some examples • Communicates ideas and information in a general response • Uses basic industry terminology	4–5
• Demonstrates a limited understanding of how technology is used by manufacturers • Uses limited industry terminology	1–3

Answers could include:

Common technology used in petrol and diesel vehicles to gain efficiency and reduce exhaust emissions

- Stronger and lighter overall construction due to the use of high tensile steels and aluminium in body construction, which results in less work for the engine, meaning improved fuel efficiency and less exhaust emissions
- Rolling resistance reduced with new tyre / trans technology, which reduces the mechanical energy required by the engine
- C.D. (air resistance) reduced due to body design, which reduces drag and improves fuel efficiency through the reduction of energy required
- Precise fuel injection (direct) in time and quantity due to closed loop control, which limits fuel wastage and maximises burn efficiency
- Forced induction with small capacity engines, which provides excellent power output when needed, with a reduction in fuel compared to larger engines with equivalent power output
- Treatment of exhaust with multiple catalytic converters to larger engines with equivalent power output.

Petrol Engine

- Spark timing to meet all operating conditions, which maximises the efficiency of the burn, resulting in lower fuel demands and improved power
- Use of valve timing to use Miller cycle advantages

Diesel

- Precise fuel injection / multiple injection to reduce knock and emissions
- Soot filters to remove soot from exhaust stream, which results in less pollutants through the exhaust system

Automotive

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	AURT270278A Use and maintain workplace tools and equipment (p96)					X	X		X
2	1	AURC270789A Communicate effectively in the workplace (p56)	X		X	X				
3	1	AURC270103A Apply safe working practices (p39)			X			X		X
4	1	AURT270278A Use and maintain workplace tools and equipment (p95 & p91)			X	X		X	X	X
5	1	Automotive systems and components (p20)							X	X
6	1	AURE218708A Carry out repairs to single electrical circuits (p82)			X				X	X
7	1	AURE218708A Carry out repairs to single electrical circuits (p80)							X	X
8	1	AURE218670A Service, maintain or replace batteries (p69) AURE218708A Carry out repairs to single electrical circuits (p82)			X				X	X
9	1	AURT270278A Use and maintain tools and equipment (p91)							X	X
10	1	AURC252103A Apply basic automotive troubleshooting processes (p25, p30, p31)			X				X	X
11	1	AURC270789A Communicate effectively in the workplace (p53)	X	X		X				
12	1	AURC272003A Apply environmental regulations and best practice in the workplace or business (p106) Automotive industry induction (p14)	X		X	X				
13	1	AURC272003A Apply environmental regulations and best practice in the workplace or business (p118) AURC270103A Apply safe working practices (p33)			X				X	X

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
14	1	Automotive systems and components (p21)			X				X	X
15	1	AURC252103A Apply basic automotive troubleshooting processes (p31)			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
16 (a)	3	AURC252103A Apply basic automotive troubleshooting processes (p31)			X				X	X
16 (b)	5	AURE218708A Carry out repairs to single electric circuits (p80) AURC252103A Apply basic automotive troubleshooting processes (p31)			X	X			X	X
17 (a)	2	Automotive systems and components (p21)							X	X
17 (b)	3	Automotive systems and components (p21)							X	X
18 (a)	1	Automotive systems and components (p22)							X	X
18 (b)	3	Automotive systems and components (p22)							X	X
19 (a)	1	AURC252103A Apply basic automotive troubleshooting processes (p31)	X						X	X
19 (b)	2	AURT270278A Use and maintain tools and equipment (p91) Automotive systems and components (p20)							X	X
19 (c)	4	AURT270278A Use and maintain tools and equipment (p94)	X						X	X
20 (a)	3	Automotive systems and components (p21)							X	X
20 (b)	4	Automotive systems and components (p21)	X						X	X

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	4	AURC272003A Apply environmental regulations and best practice in a workplace or business (p116)	X			X	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
22	15	Automotive systems and components (p21)	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
23 (a)	5	Automotive systems and components (p20)	X		X				X	X
23 (b)	10	Automotive systems and components (p20) AURC272003A Apply environmental regulations and best practice in a workplace or business (p101)	X		X				X	X