BOARD OF STUDIES
NEW SOUTH WALES

2011 Automotive HSC Examination
'Sample Answers'

When examination committees develop questions for the examination, they may write 'sample answers' or, in the case of some questions, 'answers could include'. The committees do this to ensure that the questions will effectively assess students' knowledge and skills.

This material is also provided to the Supervisor of Marking, to give some guidance about the nature and scope of the responses the committee expected students would produce. How sample answers are used at marking centres varies. Sample answers may be used extensively and even modified at the marking centre OR they may be considered only briefly at the beginning of marking. In a few cases, the sample answers may not be used at all at marking.

The Board publishes this information to assist in understanding how the marking guidelines were implemented.

The 'sample answers' or similar advice contained in this document are not intended to be exemplary or even complete answers or responses. As they are part of the examination committee's 'working document', they may contain typographical errors, omissions, or only some of the possible correct answers.

Section II

Question 16 (a)

Sample answer:

V: Connecting rod or con-rod
W: Valve
X: Cam shaft
Y: Piston
Z: Fly wheel (or accept ring gear)

Question 16 (b)

Sample answer:

The four strokes of a petrol engine during one cycle are:

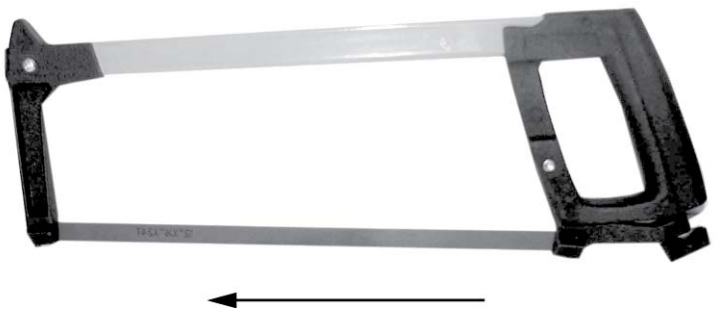
1. *Intake* – the piston is moving down and the air-fuel mixture is being drawn into the cylinder through the open intake valve.
2. *Compression* – the piston is moving up and the air-fuel mixture is being compressed in the cylinder. Both valves are closed.
3. *Power* – combustion of the air-fuel mixture has taken place and the piston is being forced down the cylinder by the pressure of the gases.
4. *Exhaust* – the piston is moving up and forcing the burnt gases out through the open exhaust valve.

Answers could include:

- Comprehensive explanation of the Otto cycle
- Diagrams of the Otto cycle to illustrate its operation
- Non-specific terms, but showing an understanding of the process

Question 17 (a)

Sample answer:



Answers could include:

A description that includes teeth facing to the front of the hacksaw, or an arrow that shows a forward bias.

Question 17 (b)

Sample answer:

When the threads in a bore are excessively damaged, it is better to replace them than to try to tap them. A thread insert can be used to restore the original threads. Inserts require drilling the bore to a larger diameter and tapping that bore to allow the insert to be screwed into it. The inner threaded diameter of the insert will provide fresh threads for the bolt.

Answers could include:

- The threads can be replaced by the use of threaded inserts; the helically coiled insert is the most commonly used
- The hole is welded and re-tapped
- Inserts can be used

Question 17 (c) (i)

Sample answer:

Vernier calipers

Question 17 (c) (ii)

Sample answer:

- Outside diameter
- Inside diameter
- Depth or height

Question 17 (c) (iii)

Sample answer:

3.60 mm

Answers could include:

3.56 mm to 3.64 mm will also be accepted

Question 18 (a)

Sample answer:

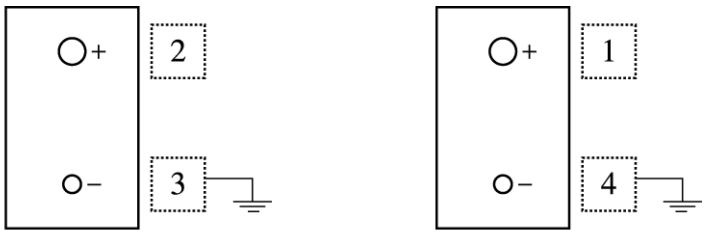
Always wear safety glasses or goggles when working with batteries. When a battery is charging or discharging, it gives off highly explosive hydrogen gas. Any flame or spark can ignite this gas, causing the battery to violently explode, propelling the vent caps at a high velocity, and spraying acid in a wide area. Sulfuric acid can cause severe skin burns.

Answers could include:

- Hydrogen gas
- Wear correct PPE
- Work in a ventilated area
- Avoid any sparks and flames

Question 18 (b)

Sample answer:



Good battery Discharged battery

1 or 2 reversed will be accepted.

Question 18 (c)

Sample answer:

- Visually inspect the wiring for breakage
- Determine damage by conducting a pinout test
- Select the correct current carrying capacity wire to repair the wiring harness
- Join and solder the wire, or use crimp connectors where appropriate
- Correctly insulate the repaired wiring

Question 19 (a)

Sample answer:

A bund is a low wall/ramp used on a work area that is built to contain liquids.
Bunded areas must be roofed.

Answers could include:

- A bund is a low wall built to contain liquids. It can be made of any impervious material, such as bricks or concrete.
- A bund should be large enough to hold the contents of the largest container plus 10%. Bunded areas should be roofed to prevent rain from entering them and washing pollutants out or rusting the drums. Consult WorkCover when installing roofing over bunded areas. Guidelines are available from the EPA or from your local council.

- Speed humps about 100 mm high across the entrance to the workshop can turn the whole workshop into a bunded area. If any spills do occur, they are contained within the work area and can be mopped up. This can be an acceptable alternative to building a specific bunded area, as long as you can show that no spills can escape. Use speed humps as bunds only if they are contained in a roofed area.
- A ramp across the bund will allow the easy placement and removal of containers.
- Paint bunds yellow for safety.

Question 19 (b)

Sample answer:

All hazardous chemicals should be stored in flammable liquid steel cabinets. All chemicals should be clearly labelled, to enable them to be identified.

All liquids should be stored above a spill container that can hold any accidental slippage up to 10% above drum storage capacity.

Answers could include:

- Ensure that all chemicals are stored in a designated area away from stormwater drains. Cover, seal and bund the storage area.
- Store and dispose of each type of chemical in a separate container. Clearly label each container with the name of the chemical it contains.
- Keep an up-to-date and legible list of all chemicals held.
- Inspect storage containers regularly. Replace them if they are rusted, damaged or likely to leak. Allow yourself easy access.
- Keep all sharp parts away from chemical or liquid containers to avoid damage and spills.

Question 20 (a)

Sample answer:

Safe operating procedure (SOP)

Question 20 (b)

Sample answer:

Remove from service and tag it, then inform the workplace supervisor.

Answer could include:

Cut off the plug

Question 20 (c)

Sample answer

Check the hoist safe working load (SWL). Ensure the hoist is in full operational condition. Ensure the work area is free of obstructions and is the correct height for the vehicle to be lifted. Position the lifting pads at the manufacturer's recommended lifting points. Raise the hoist until the supports contact the vehicle. Recheck that the pads are securely positioned. Gently lift the vehicle to work height. Engage the safety locks.

Answers could include:

- Inspect your lift daily. Never operate it if it malfunctions or if it has broken or damaged parts. Repairs should be made with the original equipment parts.
- Operating controls are designed to close when released. Do not block open or override them.
- Never overload your lift. The manufacturer's rated capacity is shown on the nameplate affixed to the lift.
- Positioning of the vehicle and operation of the lift should be done only by trained and authorised personnel.
- Never raise the vehicle with anyone inside it. Customers or by-standers should not be in the lift area during operation.
- Always keep the lift area free of obstructions, grease, oil, trash and other debris.
- Before driving the vehicle over the lift, position the arms and supports to provide unobstructed clearance. Do not hit or run over the lift arms, adapters or axle supports. This could damage the lift or the vehicle.
- Load the vehicle on the lift carefully. Position the lift supports to contact at the vehicle manufacturer's recommended lifting points. Raise the lift until the supports contact the vehicle. Check the supports for secure contact with the vehicle.
- Before lowering the lift, be sure the tool trays, stands, etc are removed from under the vehicle. Release the locking devices before attempting to lower the lift.

Section III

Question 21

Sample answers:

The troubleshooting process is a process of elimination whereby a technician applies his or her diagnostic knowledge to determine the cause of a vehicle fault. This process uses the information acquired by speaking to the customer, listening to their description of the fault, and eliminating those items that will not be involved in the fault. Open-ended questions must sometimes be asked of the customer. A visual inspection may be made and a test drive may be taken to allow further investigation and to give clarity to the customer's interpretation. These findings are sometimes recorded on the job card to assist in the workshop.

For example, if the customer complained about a noise in the wheel, the technician could enquire as to the type of noise and whether the noise occurs regardless of road speed, when making a turn to the left or the right, or when not turning. This enquiry stage is the first in the troubleshooting process.

After gaining information from the customer, the technician must then interpret the information – for example, by taking the vehicle onto a bumpy road to check wheel noise, or by turning the wheel left and right. The technician may determine from his or her experience and knowledge that the noise is from a front-wheel bearing. Through the application of a series of other tests, this diagnosis will be confirmed or rejected.

Further testing may be required to focus in on the repairs needed.

OR

The troubleshooting process consists of six stages and is an effective way of determining the cause of a vehicle fault.

First, you should gather information. You should ask the customer questions (preferably open-type) about the fault – for example, 'When did this happen?', 'Has it happened before?' or 'Any other problems?' This helps you identify what the problem could be and is an important part of the troubleshooting process.

Second, you should confirm the symptoms. The customer may just be making a mistake, so you should double-check it yourself – for example, try and start the car if the customer says that it isn't starting properly. If the problem is there, you have confirmed the symptoms and you know you need to fix it.

Third, you must decide if there is a fault. Some problems are just normal conditions of the car – for example, the customer says 'it is very loud and there is a problem', but actually it is just a loud car.

The fourth stage is to locate the fault, if there is one. Refer to the information the customer has given you for this stage – for example, find the source of the noise the customer told you about, or test the spark plugs if the car isn't starting properly. Always do this stage in the most obvious ways first, through a process of elimination or by researching the problems that the model of the car often has.

The fifth stage is to repair or replace parts – for example, repair a broken part that shakes or causes noise, or replace the plug leads. If you cannot fix the problem, refer the customer to a specialised auto technician.

The sixth stage is to retest and re-evaluate. If the problem is still there, you will have to start the process over again. If it is fixed, the troubleshooting process has been effectively followed and the vehicle's fault has been determined and resolved.

This shows how the troubleshooting process can be used to determine the cause of a vehicle fault, as it effectively gathers information and uses the process of elimination to find and fix the problem.

Section IV

Question 22 (a)

Sample answer:

FWD advantages: compact drive train, more passenger space inside, easier to design body shape, more flexibility, more storage space inside, components all in one place for servicing, weight over front wheels leads to better traction, and car goes where it is steered.

RWD advantages: better weight distribution with gear box further back, easier to control, no torque steer, better for performance cars due to better dynamics, separate parts mean more space for a mechanic to work, and can cope with more power.

FWD disadvantages: all in one place makes servicing difficult, complex drive train prone to damage and need of expensive repair, torque steer, and poor weight distribution.

RWD disadvantages: parts need to be connected by long drive shafts and this can cause issues, rear tyre wear due to lack of traction, and hump down the middle of the car reduces interior space and is ugly.

Question 22 (b)

Sample answer:

Hybrid cars use a combination of two power systems, most commonly an internal combustion engine coupled with an electric motor. The electric motor is used at low speeds and as an addition to the internal combustion engine when extra power is needed. These vehicles also have stop–start technology, which will turn the motor on and off as required, such as at traffic lights. They also use the braking of the car to supply regeneration to the dynamo, which will help charge the batteries; this can also occur as the engine is used for braking. The result of this design is that lower levels of carbon monoxide and other pollutants are achieved, as the internal combustion engine is small and efficient. It has to do less work due to the help from the electric motor. The hybrid vehicle is able to have a smaller environmental footprint because of the complex system it employs. Some critics downplay its benefit due to the issue of long-term disposal of its batteries, and the vehicle itself will need to be recycled or reused to again lower its environmental impact. Hybrid vehicles contribute to sustainability as they use less fuel, less materials, and less of the planet's other resources.

These vehicles are also designed to have lower drag coefficients, so they slip through the air and are very fuel efficient.