2009 HSC Metal and Engineering
Sample Answers

This document contains 'sample answers', or, in the case of some questions, 'answer may include'. These are developed by the examination committee for two purposes. The committee does this:

(a) as part of the development of the examination paper to ensure the questions will effectively assess students' knowledge and skills, and

(b) in order to provide some advice to the Supervisor of Marking about the nature and scope of the responses expected of students.

The 'sample answers' or similar advice, are not intended to be exemplary or even complete responses. They have been reproduced in their original form as part of the examination committee's 'working document'. While the handwritten notes have been typed for legibility, no further editorial change or addition has occurred.

Section II

Question 16 (a)

Sample answer/Answers could include:

Exploded (key word) isometric / pictorial

Question 16 (b)

Sample answer/Answers could include:

3, 2 in the CRANK ARM and 1 in the KNOB

Question 16 (c)

Sample answer/Answers could include:

PIVOT Length (30) – KNOB Functional length (30 – 3 C'bore) = 30 – 27 = 3mm clearance

Question 16 (d)

Sample answer/Answers could include:

Thickness 3mm; Material MS (Mild steel); Width ∅25 / 25mm

Question 16 (e)

Sample answer/Answers could include:

Riveting – Countersink rear of hole, assemble and support pivot, use a ball pein hammer and mushroom excess pivot to fill the countersink. Remove excess with file and finish appropriately.

Question 17 (a)

Sample answer/Answers could include:

Marking Out: Provides a logical sequence of steps, starting with a centre line and calculate/measure and mark from the end opposite the holes

Tools: Rule, scriber, Engineers square, calipers/dividers

Manufacture: Provides a logical sequence of steps. Clamp piece in machine vice; drill ∅5 hole first (to prevent "wandering", the ∅8. File waste to form the flats between holes. Beburr and finish.

Tools: Bench or pedestal drill, machine vice, ∅5 and ∅8 twist drill, bench vice, assorted files, abrasive cloth, appropriate PPE

Question 17 (b)

Sample answer/Answers could include:

Checking: Double check measurement prior to drill, have another person check them. Check the appropriate planned manufacturing sequence has been followed.

Question 18 (a) (i)

Sample answer/Answers could include:

100^{th} of a millimetre, 0.01 mm

Question 18 (a) (ii)

Sample answer/Answers could include:

Depth, height

Question 18 (b)

Sample answer/Answers could include:

Issues could include: Security, climatic effects, OHS considerations, stability and ease of access, clean before storing, turning battery off after use.

Question 18 (c)

Sample answer/Answers could include:

Responses could include but are not limited to the following aspects:
Easy to read the display, quicker – no need to read from graduated scales, no technical requirements needed, reduces errors of reading and recording measurements.

Question 19 (a)

Sample answer/Answers could include:

Taper (key word) tap; to start the cutting of an internal thread or full thread in thin metal

Question 19 (b) (i)

Sample answer/Answers could include:

Drill size = 10.8mm

Question 19 (b) (ii)

Sample answer/Answers could include:

Working: 45 * 300 / 10.8 = 1250 RPM

Question 19 (c)

Sample answer/Answers could include:

Responses could include but are not limited to the following precautions:

- The job should be appropriately clamped and secured to prevent lateral movement of both the job and the tap wrench
- Using a suitable lubricant aids the cutting action through the reduction of the force required to rotate the tap wrench
- Through using the appropriate method – $\frac{1}{4}$ turn forward, $\frac{1}{2}$ turn back, effective removal of swarf is made
- These precautions help prevent tap breakage by removing or reducing forces on the tools and the job

Section III

Question 20

Sample answer/Answers could include:

Australian manufacturing industries are increasingly adopting quality management systems that are adopted throughout every stage of production and operation of a business. While quality systems can vary in their structure and implementation, all have the same basic objective – to deliver the highest possible quality efficiently and to limit variation.

- quality planning and assurance, and
- quality control, and
- quality inspection.

Quality assurance can be basically described as planning to meet customer's needs. It is about planning engineering processes so that both the supplier and the customer are satisfied with the quality and consistency of the goods or services provided.

Within this phase there are several strategies that a company might employ. Primary is the creation of an open and frank dialogue with the customer so that details of expectations are clearly communicated and clarified. Decisions are based on gathered data and factual information not hunches and hearsay.

The design of a quality process to deliver the goods and services involves the development of specifications and job instructions so that the production "right the first time". Getting it right the first time means adhering to the quality standards that have been planned.

Quality control is the checks and procedures that are used to ensure that the customer's requirements are being met. The control measures are planned as part of the whole quality system. The basic principle that is used in quality control, is that controlling the process is more efficient than controlling the product. It will minimize lost production and wastage.

Strategies used by the manufacturing industries to control the process and reduce variation are many fold.

- Job instructions are a general part of an overall quality system. Job instructions or SOP's (standard operating procedures), job cards/plan set out in detail the best way to perform all the tasks in the manufacture of a product.
- Employee training and preparation is also considered important in the interpretation and delivery of the standard of work required.

Quality inspection is the testing of goods and product to see if they comply the standards specified by the customer. Inspections can be conducted at intermediate stages in the process and/or the end of production. Strategies used usually are comparison techniques against the specifications. The use of checklist, gauges and graduated measuring devices complement visual inspections by specialist engineers and line workers. Benefits include both improved product and processing.

The benefit of implementing a quality system – planning, control and inspection is the continual improvement of the production process. This leads to quality products/services, reduced costs, customer confidence, satisfaction and loyalty, good reputation, job satisfaction and increased competitiveness.

Question 21

Sample answer/Answers could include:

The roles and responsibilities of employees in the metal and engineering workplace tend to change with the scope of the work being undertaken and the size of the organisation.

In addition to employability skills, employers seek a range of personal attributes that are important to working with management, other team members and customers. Employees who effectively demonstrate these attributes are able to make a positive contribution to the workplace as well as gaining the personal satisfaction.
In the completion of workplace tasks, the appropriate personal attributes that may be present may include, but not limited to he following. They may be seen as either individual or integrated attributes when judging the effectiveness of the employee.

Workshop conduct surrounds the employees' preparedness to engage in appropriate actions and activities that make both them and their workplace a safe and productive environment.

- Correct presentation that is appropriate for the task at hand is important – dress and grooming is particularly important in aspects of personal safety.
- For work places to be effective it is important for all participants to "connect" in an environment using the benefits of the personal attributes of cooperation and flexibility. Of course, this must be viewed with respect to the industrial legislation for the particular industry.
- Employees must also have the capacity to be responsible for their own work. This involves committing to training, gaining confidence in skills, and being able to seek and accept advice. Associated with these particular attitudes are the benefits of improved quality and job satisfaction.
- Inappropriate behaviour such as practical jokes, showing off or horseplay has no place in the work environment. Not only does inappropriate behaviour present situations that increase the risks of injury, it can also lead to a loss of time and productivity.

Occupational health and safety programs can only be effective when employees adopt safe working practices. Personal attributes associated with safety that may be present include, but not limited to he following:

- The ability to follow directions of the employers and the appropriate OHS legislation is a key personal attribute when ensuring the health and safety of all people in the work place. Examples of these directions include:-
  - maintaining tools and equipment in good working condition;
  - treating machines with due deference to their potential to cause injury
  - correctly wearing and maintaining PPE. There are numerous examples that could be cited here.
- Workshop cleanliness is the responsibility of employees and employers alike. The ability to maintain a clean and tidy work environment, storing tools and equipment, using scrap bins and clear obstructions greatly reduces accidents and improves the efficiency of work practices.

Question 21 (continued)

Workplace communications is a vital element in the day to day functioning of organisations. On an employee level, competence in communicating effectively will effect how well a job is done and the level of satisfaction derived from the job. Personal attributes associated with communication that may be present include, but not limited to he following:

- Communicate through a wide range of sources
  - Listening and speaking
  - Reading and writing
  - Sketching and drawing
- Using the appropriate technical language and jargon in order to exchange information with other workers, management and customers.
- Gathering information in order to make decisions and resolve conflict.

The impact to the workplace of poor communication is production and administrative errors which are expensive in terms of lost time, wastage of materials and loss of customer confidence – and in turn the job prospects of employees.

Question 22

Sample answer/Answers could include:

Portable electric power drills are available in a wide range of types and sizes with many different features. Electric power tools that plug into 240 volts mains supply are commonly used in general workshop practice across the metal and engineering industry. Cordless power drills that have rechargeable batteries are also used as are pneumatic powered drill. Notwithstanding the power source, the safety requirements and operating procedures for portable power drills are substantially the similar, and the following information will often be applicable to all types.

The use of a portable power drill involves a sequence of steps that includes pre-operation, use, shut down/clean up and storage. In outlining the hazards, risks and controls associated with portable electric power drills the details are set out in the form of a safe work procedure. (Candidates response does not have to be in this form – but should contain much of the detail)

Activity	**Hazards**	**Risk**	**Controls**
Steps in the process/task	*What could cause an injury?*	*How harmful is it? Likely hood/ Consequence*	*What can be done to minimise the risk of injury?*
Pre-operation	Electrocution	High	• Check for appropriate tags • Check drill and leads for faults • Check working area and lead is safely positioned. • Check power outlet is not damaged
	Injury to operator from drill breakage and /or jamming.	Med–High	• Select correct drill for the task • Tighten drill in chuck and remove key
Use	Injury to operator from drill breakage and /or jamming.	Med–High	• Make sure work is held securely in a convenient position • Apply even pressure and hold drill firmly • Wear appropriate PPE • Don't switch off machine while under load • Stop machine before cleaning or adjusting
Post – operation Shut down Clean up Storage	Injury to operator	Low	• Back drill out of hole to remove cuttings • Clean swarf away with a brush • Don't yank cord from power outlet