BOARD OF STUDIES
NEW SOUTH WALES

# 2010 HSC Metal and Engineering
# Sample Answers

This document contains 'sample answers', or, in the case of some questions, 'answers could 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 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)

***Answers could include:***

Shows full assembly; and/or overall 3D view of the object.

## Question 16 (b)

***Answers could include:***

Item 3 and/or Leg

## Question 16 (c)

***Answers could include:***

Shows internal detail and dimensions, joining arrangements, adjacent parts and shapes

## Question 16 (d)

***Answers could include:***

4mm, fillet weld, all round

## Question 16 (e)

***Sample answer:***

Angle $= (388 \times 2) + (588 \times 2) + (84 \times 4)$
$= 2.29 \text{ lm} \times \$2.00$
$= \$4.58$

Flat Bar $= 50 \times 4$
$= 0.2 \text{ lm} \times \$1.20$
$= \$0.24$

Total for one $= \$4.58 + \$0.24$
$= \$4.82$

Total for three $= \$4.82 \times 3$
$= \$14.46$

**Question 17 (a)**

***Sample answer:***

P - 18mm
Q - 20mm
R - 50mm

**Question 17 (b)**

***Sample answer/Answers could include:***

| *Sequence of steps – marking out* | *Tools* |
|---|---|
| – Coat 50 x 6 plate with marking medium | – Layout dye, chalk, texta marker |
| – Square end with engineers square and scriber | – Engineers square, scriber |
| – File end square to make datum end | – File |
| – Measure 50 mm from datum end and square across | – Rule, engineers square, scriber |
| – Set Jenny Calipers at 20 mm and mark parallel line to datum end and one edge | – Jenny calipers, rule |
| – Use centre punch to locate centre of ∅18 hole where lines intersect | – Centre punch and engineers hammer |
| *Sequence of steps – manufacture* | *Tools* |
| – Cut foot pad to 50 mm using cut-off saw, if available, or hacksaw | – Cut off saw or Hacksaw |
| – Use jaw guards to protect job when using vice | – Vice, jaw guard |
| – File other end square and flat to datum end using a file, deburr | – File and vice |
| – Place foot pad into machine vice of the pedestal drill | – Pedestal drill, Machine vice |
| – Pilot drill and then drill final ∅18 hole Make sure PPE worn and speed of drill is correct | |
| – Deburr the final hole using a deburring tool or larger drill | – Deburring tool, larger drill |

**Question 18 (a)**

***Answers could include:***

Pedestal drilling machine
Column drilling machine

**Question 18 (b)**

***Answers could include:***

Check:

- Work area and drill is clean and clear of obstructions
- Tagging
- Guards and shields are in place
- Correct belt speed is selected
- Table is correct height, square and secure
- Drill is properly inserted in chuck
- Drilling operation will not damage job, clamp or table

**Question 18 (c)**

***Answers could include:***

- Drill a smaller pilot hole - less material to remove, and acts as a guide therefore requires less downward force on the drill bit.
- Select the correct drill speed - use an appropriate speed appropriate to the drill diameter for optimal cutting preventing overheating/tempering drill cutting edges. The larger the diameter, the slower the speed.
- Use a suitable lubricant/coolant - apply soluble oil to act as a lubricant and coolant. This carries the heat away from the drilling operation.
- Use the correct drill feed -this is how fast the drill moves through the work. The feed rate should be such that overheating does not occur.
- Inspect drill bit for damage prior to use - correct angles on lip and web (drill gauge), no chipping or damage to cutting surfaces as these will effect the cutting performance.

### Question 19 (a)

***Answers could include:***

Reading error, parallax error or alignment error

### Question 19 (b)

***Sample answer:***

- Engineer's square - measures and tests right angles or marking lines at right angle to an edge
- Feeler gauge - used to measure small clearances
- Outside Micrometer - makes very accurate (depending on scales) outside measurements

### Question 19 (c)

***Answers could include:***

The practice '*measure twice cut once*' refers to the quality process of double-checking all measurements prior to making any cuts or removing any material. Following this quality procedure leads to:

- Less material waste
- More accurate products
- Meets customer specifications
- Quicker production time because of fewer mistakes
- Enhances company reputation
- Cheaper materials cost
- Job satisfaction

## Section III

### Question 20

***Answers could include:***

Occupational health and safety (OHS) refers to the legislation, policies, procedures and activities that aim to protect the health, safety and welfare of all people at the workplace.

Every worker has a right to a healthy and safe work environment that enables him or her to live a socially and economically productive life.

To ensure the health a safety of others in the workplace employees must:

- ensure that your actions do not put others at risk
- work safely
- use and maintain machinery and equipment properly
- ensure that your work area is free of hazards
- deliberately not create a risk to the health and safety of your co-workers.

This ensures that other workers can operate and complete their work effectively and efficiently without concerns from other worker's actions.

Employees must not intentionally or recklessly interfere with or misuse anything provided in the interests of health, safety and welfare. They must not:

- move or deface signs
- tamper with warning alarms
- remove machine guards
- 'skylark' or play jokes
- behave in a way that results in risk to others.

This will limit the risk of injury to other workers as all of these actions can distract or disrupt the basic operations and processes in the workplace.

Employees must not intentionally hinder or obstruct:

- the giving or receiving of any form of aid when a person is injured at work
- any act to avoid or prevent a serious risk to the health and safety of a person.

This obviously contributes to the wellbeing of all workers as it provides a quick and adequate response to an injury.

Employees must also cooperate with employers, which may include:

- notifying your supervisor of actual and potential hazards
- carrying out work in a safe manner
- following health and safety instructions
- taking notice of signs
- participating in safety training
- wearing or using prescribed safety equipment.

By cooperating with their employer, employees will reduce workplace accidents, which will result in less time out, lower costs and greater production.

# Section IV

## Question 21 (a)

***Answers could include:***

Emerging technology usually involves the integration of traditional engineering with electronics and computer-aided engineering in the design, prototyping and manufacture of products and processes.

Workers will need to both re-skill and/or up-skill their highly developed technical skills to match with the electronic and computer-aided technologies. Additional skills such as the ability to understand and integrate numerous processes, problem-solving and project management ability will be needed.

## Question 21 (b)

***Answers could include:***

On the job learning strategies could include, but are not limited to:

- Employment of a workplace trainer/facilitator – depending on the size of the organisation, the amount of training required, especially if new technologies are being introduced.
- Adopting the use of appropriate written materials such as SOPs and making procedures manuals as accessible as possible, with images, diagram, sketches and perhaps models of the various stages of the product during production to allow replication and checking for completeness.
- Provide a demonstration of the skill to be acquired (perhaps more than once) and then allow the worker the opportunity to practise himself and provide appropriate feedback.
- Display signage and allow workers access to large whiteboards and chalkboards for drawing symbols or pictures that enable them to make their own interpretation of new information in a way that is meaningful for them.
- Allow workers to learn new skills by shadowing other workers on the job or by being involved in team activities. This provides opportunities for workers to feel they are part of a ‘bigger corporate picture’.
- Establish a buddy program with a co-worker to provide extra support for workers who experience difficulties.

## Question 21 (c)

***Answers could include:***

An apprenticeship or traineeship can enable people to learn the latest knowledge and skills and get a qualification that is recognised across Australia.

There are differences between an apprentice and a trainee. An apprentice is trained in a skilled trade and upon successful completion will become a qualified tradesperson. Trades such as electrical, plumbing, cabinet-making and automotive mechanics are just a few that are a part of the apprenticeship scheme.

A trainee is someone being trained in a vocational area. These areas include, but are not limited to metal and engineering, information technology and hospitality. Upon completion of a traineeship participants are eligible to receive a minimum AQF qualification in the chosen vocational area.

Training requirements for apprenticeships and traineeships:

- Apprenticeships and traineeships combine work with structured training
- Traineeships vary in length from 12 months to three years
- Apprenticeships can take up to four years to complete but many apprenticeships can now be completed more quickly than the traditional four years
- Apprenticeships and traineeships can be full-time, part-time, or school-based
- Existing employees may undertake an apprenticeship or traineeship
- Apprenticeships and traineeships require employers to enter into a training contract with the apprentice or trainee
- Employers work with a training organisation and the apprentice or trainee to draw up the training plan
- Training options must be negotiated and outlined in the training plan. Aspects of training that are open to negotiation (subject to training package requirements) include: selection, content and sequencing of competency units – timing, location and mode of delivery, and the trainer or facilitator.

Training can be delivered using one or more of the following options:

- In an appropriate environment, such as an employer's premises, TAFE institute or private college where training is delivered by the training organisation
- Using flexible delivery methods, such as video link, teleconference, correspondence, work books, online self-paced learning, or an internet classroom link, where training is delivered by the training organisation
- In the workplace, where training is delivered by the employer.

Conditions of employment for apprentices and trainees

As a minimum, apprentices and trainees must be paid a training wage as outlined in the award or agreement for the occupation or industry. For most apprenticeships and traineeships, the wage is calculated as a percentage of the wage paid to qualified workers, and depends on the year or level reached during the apprenticeship or traineeship.