

B O A R D O F S T U D I E S
NEW SOUTH WALES

2006

**HIGHER SCHOOL CERTIFICATE
EXAMINATION**

Metal and Engineering

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
- Board-approved calculators may be used
- Write your Centre Number and Student Number at the top of pages 9 and 13

Total marks – 80

Section I Pages 2–6

15 marks

- Attempt Questions 1–15
- Allow about 15 minutes for this section

Section II Pages 9–16

35 marks

- Attempt Questions 16–19
- Allow about 45 minutes for this section

Section III Pages 17–19

30 marks

- Attempt TWO questions from Questions 20–22
- Allow about 1 hour for this section

Section I

15 marks

Attempt Questions 1–15

Allow about 15 minutes for this section

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

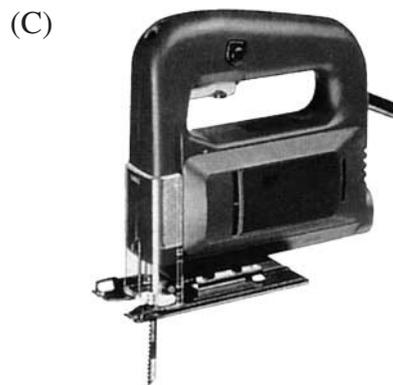
A B C D
correct
↙

1 What is the tool that is used to cut an external thread on a $\text{Ø}10$ bar?

- (A) Die
- (B) Drill
- (C) Stock
- (D) Tap

2 A $\text{Ø}5$ hole is required in sheet aluminium.

Which of the following is the most appropriate tool to create the hole?



3 What is the most appropriate tool to mark out a line parallel to an edge?

- (A) Straight edge
- (B) Outside calipers
- (C) Engineer's steel rule
- (D) Jenny or odd-leg calipers

- 4 In a company of 100 employees, who is responsible for ensuring that an emergency workplace evacuation plan exists?
- (A) The fire warden
 - (B) The government
 - (C) The OHS committee
 - (D) The individual employees
- 5 What provides power to a pneumatic tool?
- (A) Hydraulic oil
 - (B) Compressed air
 - (C) Rechargeable batteries
 - (D) Electricity-mains supply
- 6 Which of the following files would be best for the fast removal of metal from a flat surface?
- (A) Flat smooth
 - (B) Flat bastard
 - (C) Flat second cut
 - (D) Half-round second cut
- 7 Which person is directly responsible for checking on a day-to-day basis, that the standard of a product is acceptable?
- (A) Customer
 - (B) Sales manager
 - (C) Materials supplier
 - (D) Quality control officer
- 8 What is industrial housekeeping?
- (A) The process of quality control
 - (B) The planning and ordering of materials
 - (C) The maintenance of a clean and orderly workplace
 - (D) The management of all aspects of processes and projects

- 9** What is the purpose of centre punching a hole prior to drilling?
- (A) To prevent overheating of the drill bit
 - (B) To prevent the drill bit from breaking
 - (C) To avoid excessive wear on the drill bit
 - (D) To start the drill bit in the correct position
- 10** What is the main purpose of a bench grinder?
- (A) To sharpen hand tools
 - (B) To debur sheet metal edges
 - (C) To shape heavy metal sections
 - (D) To precision grind metal surfaces
- 11** Which of the following best describes a characteristic of an effective listener?
- (A) Debates key issues
 - (B) Speaks clearly and directly
 - (C) Asks questions when clarification is needed
 - (D) Interrupts when not sure of what has been said
- 12** A shaft is manufactured to the following specification:

$$\text{Ø}108_{-0.00}^{+0.10}$$

Which tool is the most appropriate to check that this shaft meets the above specification?

- (A) Feeler gauge
- (B) Vernier calipers
- (C) Outside calipers
- (D) Engineer's steel rule

- 13** What does the term *quality* mean in the manufacture of industrial products?
- (A) Products meet specifications at the lowest cost.
 - (B) Products are manufactured exclusively by one supplier.
 - (C) Products are widely available at the lowest possible cost.
 - (D) Products are manufactured to the highest standard, regardless of cost.
- 14** Employees in an engineering workplace are being exposed to harmful fumes from a chemical cleaning agent.
- Which hazard management strategy should be considered first?
- (A) Issue employees with face masks
 - (B) Install exhaust fans in the workplace
 - (C) Change the chemical cleaning agent to an alternative non-harmful product
 - (D) Instruct the employees to carefully read the Material Safety Data Sheet (MSDS)
- 15** How could an owner of an engineering company with a large and diverse workforce best communicate a new safety procedure?
- (A) Hold a meeting and tell all the workers
 - (B) Hand out a document detailing the procedure
 - (C) Ask all the supervisors to tell their workers about the procedure
 - (D) Inform small groups of workers, discuss the procedure, and use posters and signage

BLANK PAGE

BLANK PAGE

Metal and Engineering

--	--	--	--	--

Centre Number

Section II

--	--	--	--	--	--	--	--	--

Student Number

35 marks

Attempt Questions 16–19

Allow about 45 minutes for this section

Answer the questions in the spaces provided.

Marks

Question 16 (13 marks)

Detach page 22, and use drawing 2006–1 to answer this question.

- (a) Calculate the total height of the assembled CASTER. **1**

.....

- (b) The SIDE PLATE has a dimension R25 shown. **1**

What does 'R' stand for?

.....

- (c) Fully explain the meaning of the drawing symbol  (refer to location C4). **2**

.....

.....

- (d) The HEXAGONAL BOLT details specify M10 × 1.5. **2**

Explain what 'M' and '1.5' represent.

.....

.....

Question 16 continues on page 10

Question 16 (continued)

- (e) Calculate the minimum total length of material required to make SIDE PLATES for 20 casters. The material supplied is 80 mm wide and 4 mm thick. Show all working. 2

.....

.....

.....

.....

- (f) Complete the following parts list for the CASTER. 2

6	LOCK NUT	1	MS
5	HEX BOLT M10 × 1.5	1	MS
4		2	NYLON
3	WHEEL	1	
2		2	MS
1	SIDE PLATE		MS
ITEM	DESCRIPTION	NUMBER OF	MATERIAL

- (g) Name the type of drawing represented in drawing 2006–1, and explain the function of this type of drawing. 3

.....

.....

.....

.....

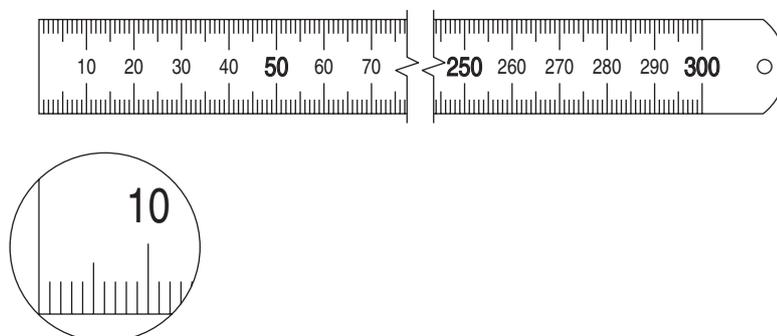
.....

.....

End of Question 16

Question 17 (6 marks)

Use the image of the engineer's steel rule and the insert showing details of the graduations to answer part (a).



(a) To what accuracy can this rule measure? **1**

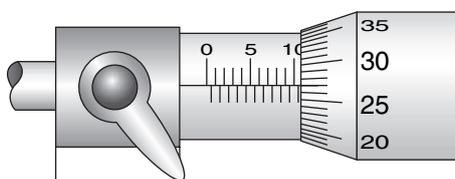
.....

(b) Engineer's steel rules are sometimes used, handled or stored inappropriately. **2**

Give an example of poor practice and its possible effect on the rule.

.....

(c) The diameter of a HEXAGONAL BOLT used in the assembly of the CASTER was checked with an outside micrometer. The illustration below shows the micrometer graduations. **3**



Complete the table.

Sleeve or barrel reading	
Thimble reading	
Total micrometer reading	

BLANK PAGE

Metal and Engineering

--	--	--	--	--

Centre Number

Section II (continued)

--	--	--	--	--	--	--	--	--

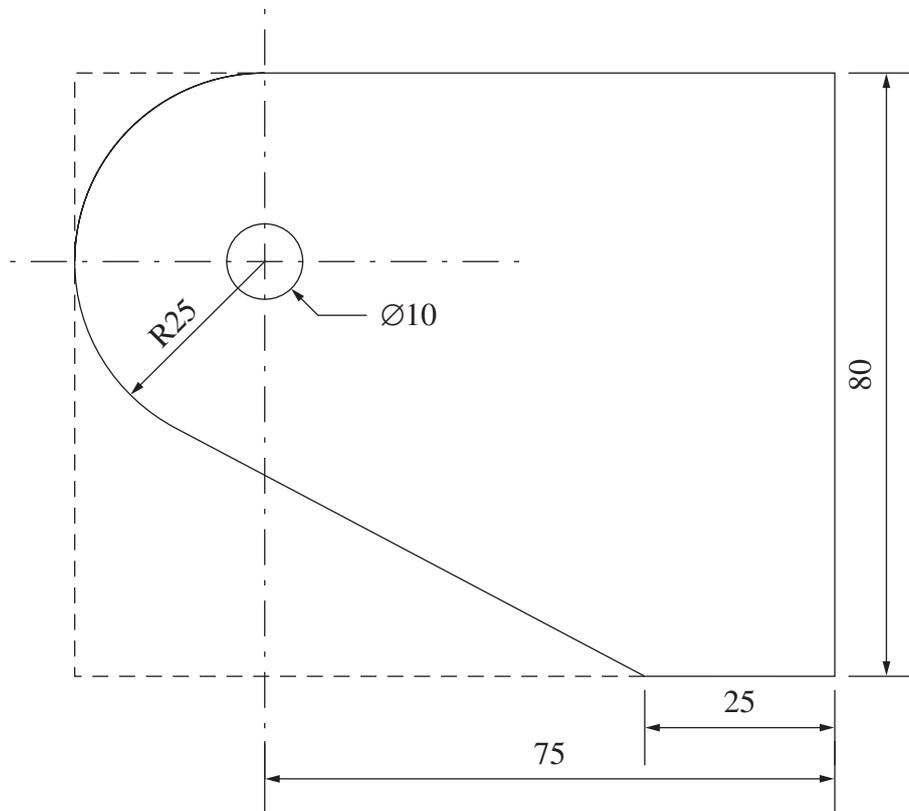
Student Number

Question 18 (7 marks)

Please turn over

Question 18 (7 marks)

Part of a proposed production sequence for the manufacture of the SIDE PLATE is shown below.



Programmed Technical Drawing Book 3, by R K Mullins & D A Cooper, 1982, reproduced with permission from Pearson Education Australia for educational purpose.

Only the following tools are available: engineer's steel rule, engineer's square, scribe, centre punch, hacksaw, hand files, twist drill and drilling machine.

Proposed Production Sequence

1. Mark off and cut material to length.
2. Mark off the taper and remove waste.
3. Mark off and drill $\varnothing 10$ mm hole.
4. Mark off and cut R25 mm arc.

Question 18 continues on page 15

Question 18 (continued)

- (a) Identify possible errors in the production sequence, and propose a more appropriate production sequence. 4

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) The SIDE PLATE is going to be manufactured in large numbers. 3

Describe quality management techniques that could be used to minimise variation between each SIDE PLATE.

.....

.....

.....

.....

.....

.....

End of Question 18

Question 19 (9 marks)

(a) Propose a workshop procedure for managing defective hand tools.

3

.....

.....

.....

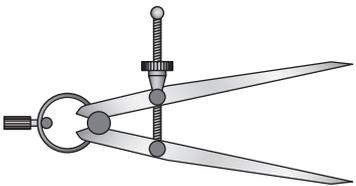
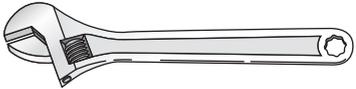
.....

.....

.....

(b) Complete the table below by naming the tools, and for each tool, list ONE application, and state ONE safety precaution that must be observed when using the tool.

6

<i>Tool</i>	<i>Name, application and safety precaution</i>
	<p>Name:</p> <p>Application:</p> <p>.....</p> <p>Safety precaution:</p> <p>.....</p>
	<p>Name:</p> <p>Application:</p> <p>.....</p> <p>Safety precaution:</p> <p>.....</p>

Metal and Engineering

Section III

30 marks

Attempt TWO questions from Questions 20–22

Allow about 1 hour for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

In your answers you will be assessed on how well you:

- demonstrate relevant knowledge and understanding
 - communicate ideas and information, using precise industry terminology and appropriate workplace examples
 - organise information in a well-reasoned and cohesive response
 - solve proposed issues or problems
-

Please turn over

In your answers you will be assessed on how well you:

- demonstrate relevant knowledge and understanding
 - communicate ideas and information, using precise industry terminology and appropriate workplace examples
 - organise information in a well-reasoned and cohesive response
 - solve proposed issues or problems
-

Question 20 (15 marks)

A company is required to make the cover plate shown.

Awaiting Copyright Clearance

Recommend a detailed sequence of steps to manufacture the cover plate. In your answer, consider the tools required, their safe use, and the appropriate application to ensure a quality product.

NOTE. Only marking-out tools, hand tools and a bench drill are available.

Question 21 (15 marks)

Assess the role of personal protective equipment (PPE) in reducing the total cost of workplace injuries for both employers and employees.

Make reference to a range of personal protective equipment and clothing encountered in a metal and engineering workplace.

Question 22 (15 marks)

The table below helps employers to assess and rank the severity of risks.

<i>How likely is it to hurt someone?</i>	<i>How severely could it hurt someone?</i>			
	Kill or permanently disable	Long-term illness or serious injury	Medical attention and several days off work	First aid needed
Very likely – could happen any time	1	1	2	3
Likely – could happen sometime	1	2	3	4
Unlikely – could happen, but very rarely	2	3	4	5
Very unlikely – could happen, but probably never will	3	4	5	6

With reference to the risk assessment table, explain the management of hazards and risks in a metal and engineering workplace.

In your answer include reference to the ‘hierarchy of hazard control’, safe work practices and OHS training.

End of paper

BLANK PAGE

Metal and Engineering

Detach this sheet and use Drawing 2006–1 to answer Question 16.

Please turn over

1

2

3

4

5

DO NOT SCALE

A

A

B

B

C

C

D

D

E

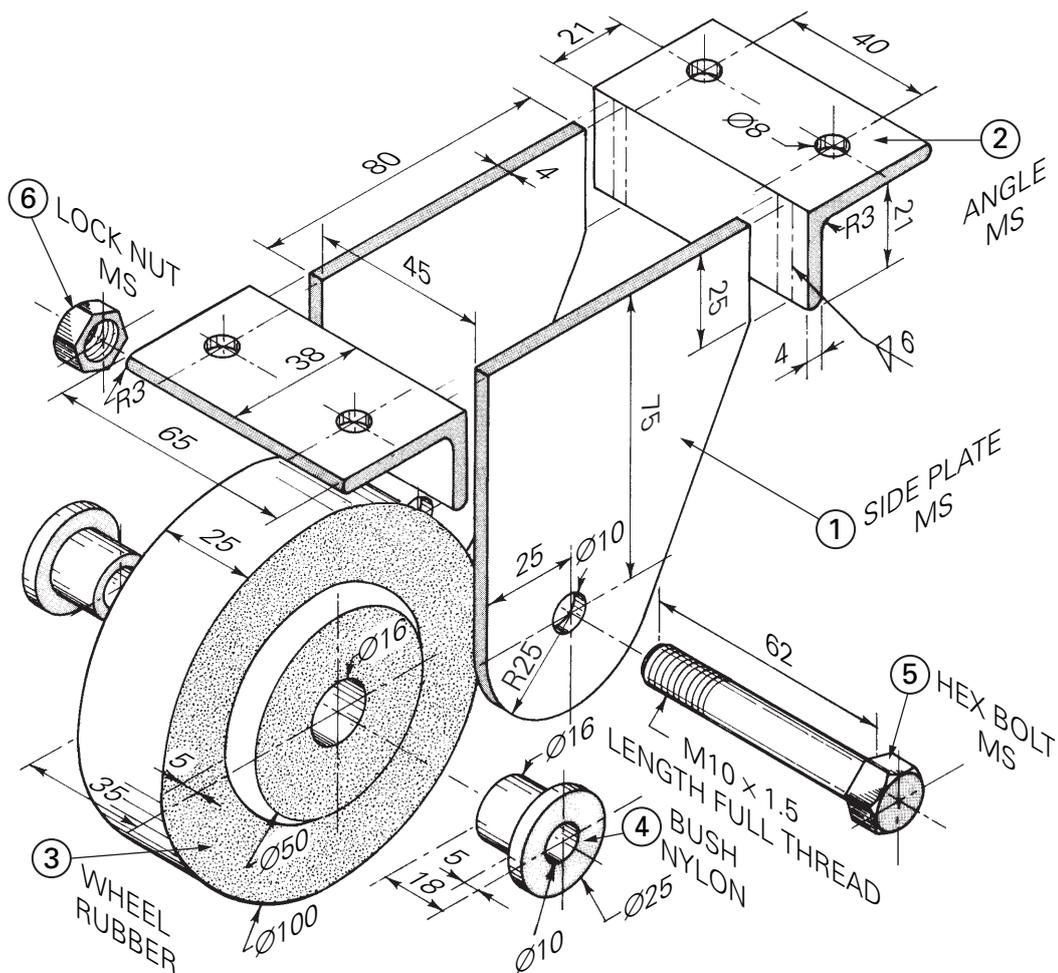
E

F

F

G

G



Programmed Technical
Drawing Book 3, by R K
Mullins & D A Cooper,
1982, reproduced with
permission from Pearson
Education Australia for
educational purpose.

ALL DIMENSIONS IN MILLIMETRES
TOLERANCES

LINEAR
ANGULAR

MATERIAL

DRAWN	JR
TRACED	-
CHECKED	WC
APPROVED	TC
ISSUED	1.1.06
RECORD OF ISSUE	
A	

BOARD OF STUDIES

TITLE

CASTER

DRAWING PRACTICE
AS 1100

FINISH

SCALE
NTS

SIZE
A4

DRWG
N

2006-1

SHT

1

2

3

4

5