

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

2004

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 2–7

15 marks

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

Section II Pages 9–15

35 marks

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

Section III Pages 17–18

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 'Out of Service' tags are commonly used to tag machines in industrial situations.

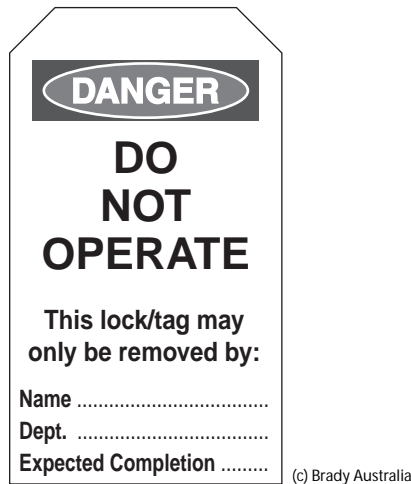


Figure 1

Who is authorised to remove the tag shown in Figure 1?

- (A) The machine operator
- (B) The person who attached the tag
- (C) A representative from WorkCover
- (D) A representative of the Occupational Health and Safety (OHS) committee

2 What is the most important reason why accidents and injuries should be investigated in an engineering workplace?

- (A) To write a safety manual
- (B) To purchase new safety equipment
- (C) To find out who caused the accident or injury
- (D) To prevent similar accidents and injuries from happening again

3 Which hand-held power saw should be used to cut irregular shapes in sheet metal?

- (A) Hacksaw
- (B) Hole saw
- (C) Jigsaw
- (D) Circular saw

- 4 Who is responsible for safe work practices within the workplace?
- (A) The safety officer
 - (B) The OHS committee
 - (C) The workplace cleaner
 - (D) All people in the workplace
- 5 What type of engineering drawing shows all the dimensions and information required to manufacture a component?
- (A) Detail drawing
 - (B) Geometric drawing
 - (C) Sub-assembly drawing
 - (D) General assembly drawing
- 6 A bench grinder is shown in Figure 2.

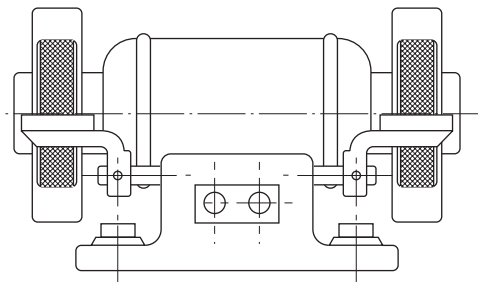


Figure 2

What should be checked, and adjusted if required, before the grinder shown in Figure 2 is used?

- (A) The distance between the two wheels
- (B) The distance between the bench and the wheels
- (C) The distance between the rests and the wheels
- (D) The distance between the protective guards and the wheels

- 7 Part of a micrometer is shown in Figure 3.

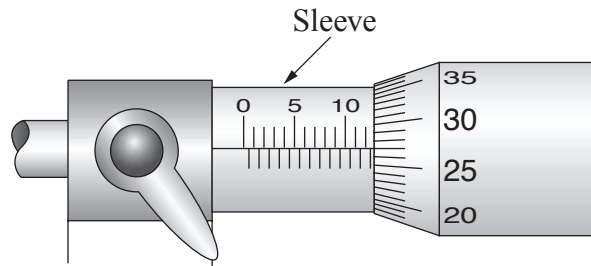


Figure 3 *Engineering - Workbook 3, Copyright(C) 2001 D.A Schlyder*

What is the smallest increment that can be measured on the sleeve of the micrometer shown in Figure 3?

- (A) 0.01 mm
 - (B) 0.05 mm
 - (C) 0.50 mm
 - (D) 5.00 mm
- 8 Following a hazard identification process, what control strategy should be implemented first?
- (A) Eliminate the hazard.
 - (B) Change the way the job is done.
 - (C) Keep the hazard and people apart.
 - (D) Supply personal protective equipment.
- 9 A metal component requiring filing is shown in Figure 4.

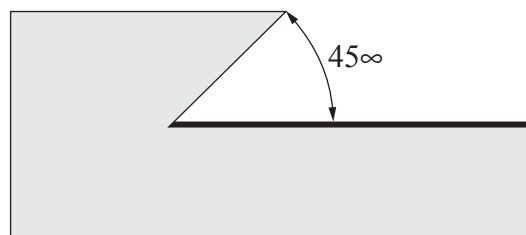


Figure 4

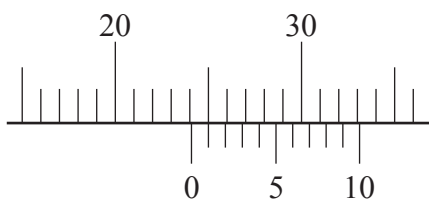
Which tool would be used to file the metal surface indicated by the thick line in Figure 4?

- (A) Hand file
- (B) Half-round file
- (C) Round file
- (D) Triangular or three-corner file

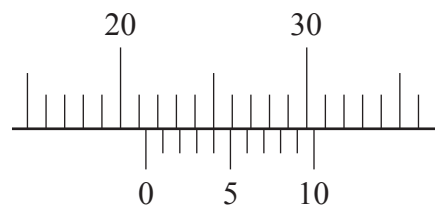
- 10 In which tool are the jaws adjusted to fit an object by using a set screw at the end of the handle?
- (A) Vice grips
 - (B) Multigrips
 - (C) Stillson wrench
 - (D) Shifting spanner

- 11 On which of the following vernier scales is a reading of 21.4 shown?

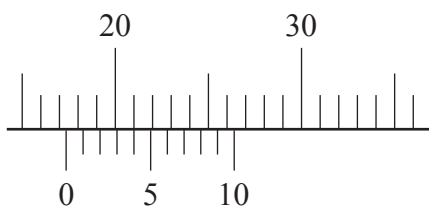
(A)



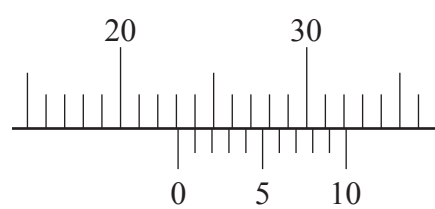
(B)



(C)



(D)



Engineering - Workbook 3, Copyright(c) 2001 D.A Schlyder

- 12 Which organisation is responsible for delivering training to trainees and apprentices?
- (A) Registered Training Organisation (RTO)
 - (B) Industry Training Advisory Board (ITAB)
 - (C) Australian Council of Trade Unions (ACTU)
 - (D) Australian National Training Authority (ANTA)

- 13** How can an employee in an engineering workshop best demonstrate effective verbal communication?
- (A) Make notes for future reference.
 - (B) Observe the supervisor's body language.
 - (C) Acknowledge the supervisor's requirements.
 - (D) Listen and if necessary ask for clarification.
- 14** What is one of the major aims of current metal industry awards?
- (A) To establish the right of employers to take sick leave
 - (B) To establish standard entitlements for employer groups
 - (C) To establish standard entitlements for union members only
 - (D) To establish the right of all employees to upgrade their skills
- 15** What is the main purpose of quality procedures in manufacturing processes?
- (A) To identify and report all variations from requirements
 - (B) To identify all customer requirements and specifications
 - (C) To ensure the finished product meets all specifications
 - (D) To ensure the finished product meets all safety requirements

BLANK PAGE

| | | | | |
|--|--|--|--|--|
| | | | | |
|--|--|--|--|--|

Centre Number

Section II

| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|

Student Number

35 marks

Attempt Questions 16–19

Allow about 45 minutes for this section

Detach the stimulus booklet, pages 19–22, and use Drawings 2004–1, 2004–2 and 2004–3 to answer Questions 16–19.

Answer the questions in the spaces provided.

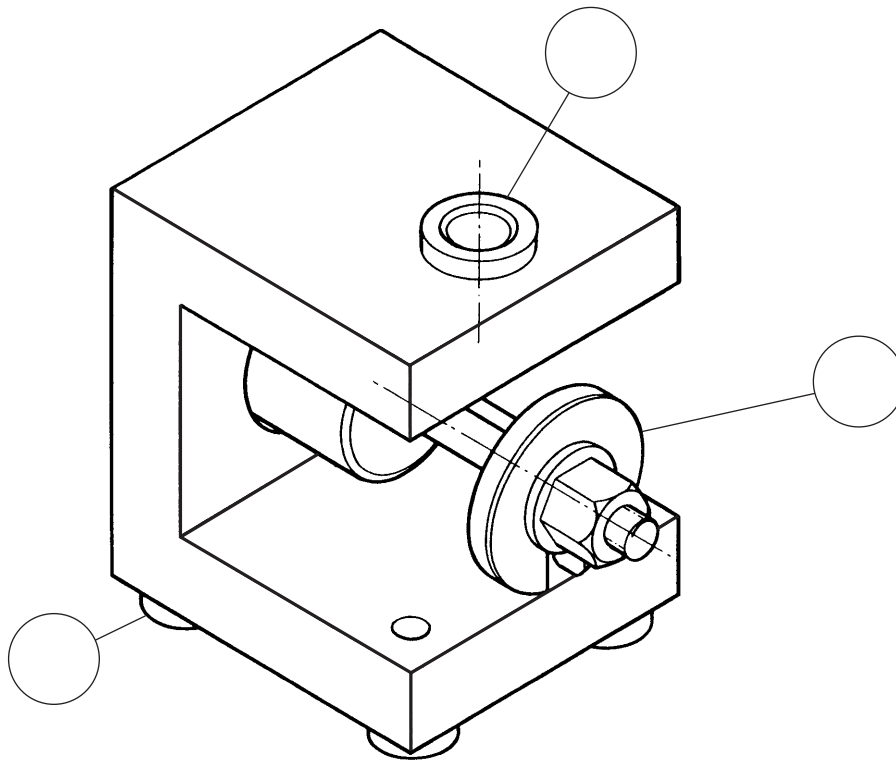
Marks

An engineering firm is to manufacture a large number of bushes, as shown in Drawing 2004–3. Each BUSH will be machined using a lathe and then the $\text{Ø}20$ hole will be drilled using the DRILLING JIG, Drawings 2004–1 and 2004–2.

Question 16 (14 marks)

Refer to Drawings 2004–1, 2004–2 and 2004–3 to answer parts (a)–(e).

- (a) On the drawing below, identify the parts by inserting the item number in the circles provided. **3**



Question 16 continues on page 10

Question 16 (continued)

- (b) What is the thread size on the LOCATION PIN, Item 3, that screws into the CHANNEL, Item 2? **2**

.....
.....

- (c) Explain the purpose of the SLOT in the C-WASHER, Item 4. **2**

.....
.....
.....
.....

- (d) Describe how the DRILLING JIG holds the BUSH, Drawing 2004–3, in position for drilling the Ø20 hole. **3**

.....
.....
.....
.....
.....

- (e) Identify problems that may lead to the LOCATION PIN, Item 3, being damaged during the Ø20 drilling operation. Outline the precautions that could be taken to overcome the problems. **4**

.....
.....
.....
.....
.....
.....

End of Question 16

Question 17 (6 marks)

Refer to Drawings 2004–2 and 2004–3 to answer parts (b)–(c).

- (a) Define the term *tolerance*. 1

.....

- (b) The internal diameter of the BUSH has to slide over the Ø50 on the LOCATION PIN. 2

Complete the table below.

| | | |
|--------------|-------------|---------|
| Nominal size | / | Ø50 |
| Basic size | / | Ø50.000 |
| BUSH | Upper limit | |
| | Lower limit | |
| | Tolerance | |

- (c) Calculate the MAXIMUM clearance possible between the hole in the BUSH and the LOCATING PIN. Show all working. 3

.....

BLANK PAGE

| | | | | |
|--|--|--|--|--|
| | | | | |
|--|--|--|--|--|

Centre Number

Section II (continued)

| | | | | | | | | |
|--|--|--|--|--|--|--|--|--|
| | | | | | | | | |
|--|--|--|--|--|--|--|--|--|

Student Number

Marks

Question 18 (7 marks)

- (a) Name the drill shown in Figure 5. **1**

| |
|------------------------------|
| Awaiting Copyright Clearance |
|------------------------------|

Figure 5

.....

- (b) Identify the TWO features of the drill being checked in Figure 6. **2**

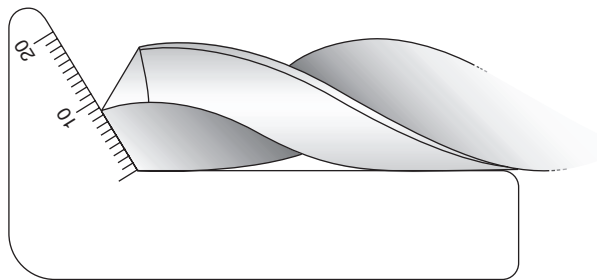


Figure 6

.....
.....

Question 18 continues on page 14

Question 18 (continued)

- (c) When drilling the Ø20 hole in the BUSH the correct drill speed (rev/min) should be selected. The drilling machine has no drill speed chart. 4

Figure 7 shows the only information available.

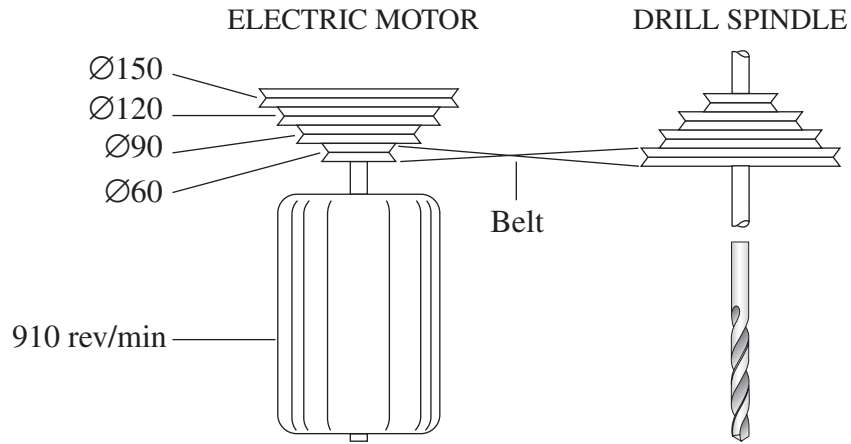


Figure 7

Using the formula below, calculate the drill speed in rev/min with the belt in the position shown. Show all working.

$$\text{rev/min of driver pulley} \times \text{diameter of driver pulley} = \text{rev/min of follower pulley} \times \text{diameter of follower pulley}$$

$$R_D \times D_D = R_F \times D_F$$

.....

.....

.....

.....

.....

.....

.....

.....

.....

End of Question 18

Question 19 (8 marks)

- (a) Name the thread cutting tool(s) used to produce the internal thread in the CHANNEL, Item 2, Drawing 2004–2. **1**

.....

- (b) Figure 8 shows three tools that are used on external threads. **3**



Figure 8

Name each tool shown in Figure 8.

P

Q

R

- (c) During use, the M14 thread on the LOCATION PIN, Item 3, Drawing 2004–2, is damaged and the NUT, Item 7, will not screw on. Select the appropriate tool from Figure 8 and describe how this tool can be used to repair the damaged thread. **4**

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

BLANK PAGE

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

Question 20 (15 marks)

Propose a job plan, identifying the procedures and tools to produce ONE plate as shown in Figure 9. Material supplied is 90 ◊ 200 ◊ 5 mild-steel plate.



Figure 9

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 21 (15 marks)

Describe the training requirements and employment conditions of an apprenticeship in NSW.

Question 22 (15 marks)

Analyse suitable methods for the prevention of hazards in a metal and engineering workplace.

End of paper

2004 HIGHER SCHOOL CERTIFICATE EXAMINATION

Metal and Engineering

Detach this booklet and use Drawings 2004–1, 2004–2 and 2004–3 to answer Questions 16–19.

Please turn over

Awaiting Copyright Clearance

Awaiting Copyright Clearance