BOARD OF STUDIES
NEW SOUTH WALES

STUDENT NUMBER

CENTRE NUMBER

HIGHER SCHOOL CERTIFICATE EXAMINATION

1999

INDUSTRIAL TECHNOLOGY

2 UNIT

SECTION II
METALS AND ENGINEERING INDUSTRIES

Total time allowed for Sections I and II—One hour and a half
(Plus 5 minutes reading time)

DIRECTIONS TO CANDIDATES

- Write your Student Number and Centre Number at the top right-hand corner of this page.
- Where appropriate, show all working for solutions neatly and clearly.
- You may use Board-approved drawing instruments and calculators.

Section II—Metals and engineering (15 marks)

- Question 4 is COMPULSORY.
- Attempt TWO questions from Questions 5, 6 and 7.
- Answer the questions in the spaces provided in this paper.

MARKER'S USE ONLY

Question				
4				
5				
6				
7				

SECTION II—METALS AND ENGINEERING

(15 Marks)

QUESTION 4 This question is COMPULSORY. (5 marks)

Figure 1 below shows the detail drawings and an exploded pictorial drawing of a wheel arbor to hold a grinding wheel.

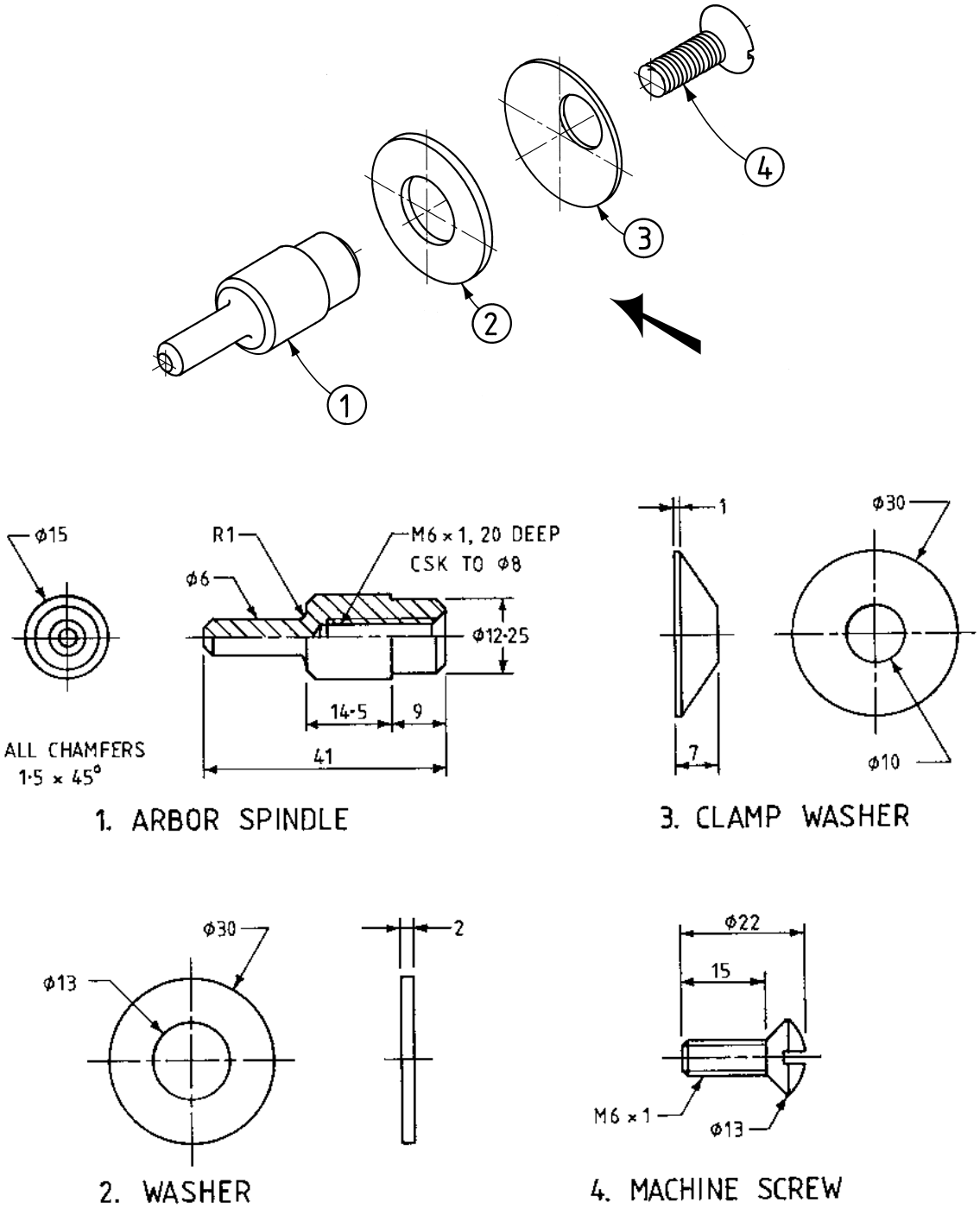


FIG. 1

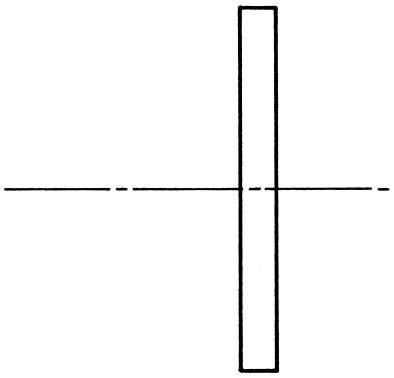
QUESTION 4 (Continued)

(a) Complete the table for the parts of the wheel arbor shown on the previous page.

Part no.	*Name*	*Length*	*Width*	*Thickness*
①				
②				
③				
④				

(b) Sketch below, the view of the assembled arbor, in the direction of the arrow.

A centre line and the grinding wheel, with a ∅12·5 bore, are shown.



Question 4 continues on page 4

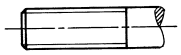
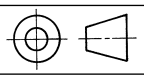
QUESTION 4 (Continued)

(c) What is the total length of the assembled arbor?

..... mm

(d) The table shows a number of drawing symbols commonly used on machine drawings.

Explain the symbols/text in the spaces provided in the table.

Symbol/Text	*Explanation*
∅	
	
	
38 PCD	
M6 × 1	
	

Attempt TWO questions from Questions 5, 6 and 7.

QUESTION 5 (5 marks)

Figure 2 shows a sketch of a wheelbarrow.

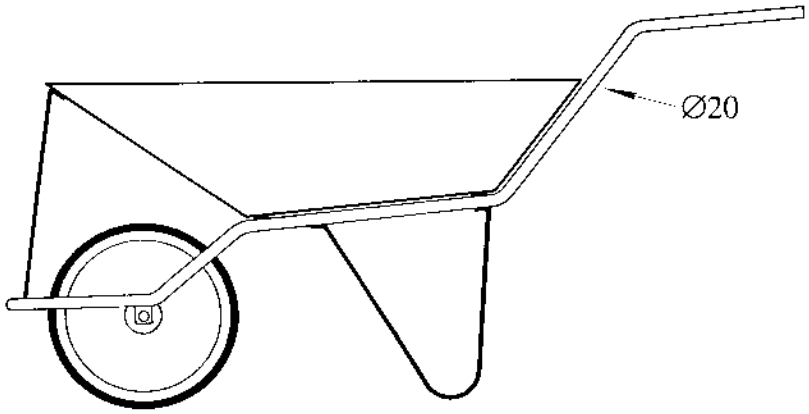


FIG. 2

(a) Describe a process that could be used to manufacture the lengths of ∅20 steel tubing shown in Figure 2.

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.....

(b) Describe a process to heat the tube before bending.

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(c) How is the bending operation carried out?

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Question 5 continues on page 6

QUESTION 5 (Continued)

(d) In order to prevent rust, the mild steel (MS) tray of the wheelbarrow has an anti-corrosive finish.

(i) Name a suitable finish.

.....

(ii) Describe how this coating is applied to the MS sheet.

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(e) Sketch ONE method of attaching the wheel of the wheelbarrow to the frame. Use the space provided below.

QUESTION 5 (Continued)

(f) The wheels are fabricated from TWO discs of MS plate and spot welded together.

(i) Use sketches to describe the spot-welding process.

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(ii) List TWO advantages and ONE disadvantage of spot welding the wheel.

Advantage 1 .....

.....

Advantage 2 .....

.....

Disadvantage 1 .....

.....

Please turn over

QUESTION 6 (5 marks)

Figure 3 shows a pictorial sketch of a small centre punch made from 12 mm square medium carbon steel.

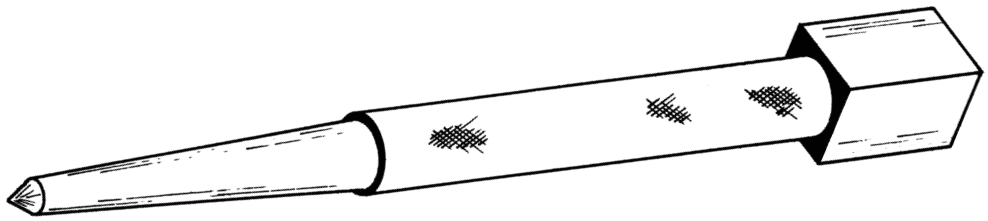

FIG. 3

(a) (i) Name TWO tools that could be used to set up the square bar in a central position in a four-jaw chuck.

Tool 1 .....

Tool 2 .....

(ii) Using sketches, describe the process of setting up the bar using a tool named in part (a) (i).

.....

.....

.....

.....

.....

.....

(b) (i) Name TWO different knurl patterns. Name ONE use for each pattern.

Knurl pattern .....

Use .....

Knurl pattern .....

Use .....

(ii) Describe how knurling is performed.

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.....

QUESTION 6 (Continued)

(c) The 12 mm square bar is turned to a diameter of 10 mm. Calculate the lathe speed for this operation. The cutting speed for carbon steel is 30 m/min.

Lathe speed ..... r.p.m.

(d) Describe a method of cutting the taper on the centre punch.

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(e) After machining, the tip of the punch must be hardened and tempered. Describe each process, indicating the correct sequence of operations.

(i) Hardening .....

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(ii) Tempering .....

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Question 6 continues on page 10

QUESTION 6 (Continued)

(f) After a period of time the tip of the punch will need to be resharpened.

(i) What process would be used?

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(ii) What precautions must be observed during this process to obtain the qualities of hardening and tempering?

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QUESTION 7 (5 marks)

Figure 4 shows a pictorial sketch of the frame of a small table manufactured from 25 mm^2 MS tube.

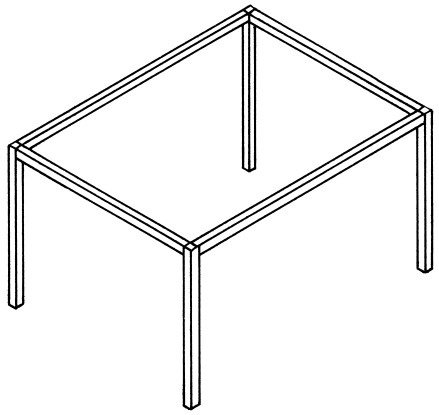

FIG. 4

(a) The joints at the corner of the table are welded.

(i) List THREE safety features that must be observed when using the arc-welding machine for this process.

1 .....

2 .....

3 .....

(ii) What is the purpose of the coating on an arc-welding electrode?

.....

.....

(b) Arc welding can be carried out using ac or dc machines.

Which machine is preferable for the process? Give a reason for your answer.

Machine used .....

Reasons .....

.....

.....

.....

Question 7 continues on page 12

QUESTION 7 (Continued)

(c) Another method of joining the corners is by oxy-acetylene welding.

(i) List TWO advantages and TWO disadvantages of using oxy-acetylene welding over arc welding for this process.

Advantages

1 .....

2 .....

Disadvantages

1 .....

2 .....

(ii) List the steps involved in lighting and adjusting the gas supply to the torch.

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(iii) Name the filler rod material that should be used.

Filler rod .....

QUESTION 7 (Continued)

(d) When mass producing the table frames it is important that the frames meet manufacturing specifications. Describe, using sketches, a process that could be used to ensure that:

(i) the tubes are cut accurately to length;

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(ii) all the frames remain square.

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