CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

METALWORK 6040/01

Paper 1 Theory, Drawing and Design

October/November 2003

2 hours 45 minutes

Additional Materials: Answer paper
A2 drawing paper (1 sheet)
Standard drawing equipment

READ THESE INSTRUCTIONS FIRST

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Section A
Answer any **three** questions.
Write your answers on the separate answer paper provided.

Section B
Answer **all** questions.
Use the A2 sheet of drawing paper prepared prior to the examination for your answers.
At the end of the examination, fasten together the separate answer paper for Section A and place it within your folded drawing paper for Section B.
The number of marks is given in brackets [ ] at the end of each question or part question.
All dimensions are in millimetres unless otherwise stated.
Except where pictorial views are used **all** diagrams are in First Angle Projection.

This document consists of **9** printed pages and **3** blank pages.

SP (BR/TC) S63636/4

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate
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Section A

Theory

Answer any **three** questions.

1 **(a)** State which **two** elements are contained in all types of steel. [2]

(b) **(i)** Name a steel which normally cannot be hardened by heating alone.

(ii) Name and describe in detail a process by which the steel named in **(b) (i)** can be hardened on the surface.

(iii) Give a reason for carrying out the process in **(b) (ii)**. [9]

(c) **(i)** Name a steel that can be hardened when heated just above its upper critical limit.

(ii) State the approximate temperature or colour of the steel at its upper critical limit.

(iii) When quenched from its upper critical limit, the steel named in **(c) (i)** will be brittle. Name and describe in detail a process by which the steel may be toughened. [6]

2 Fig. 1 shows a catch plate for a door frame made from a piece of 60×40×1 brass.

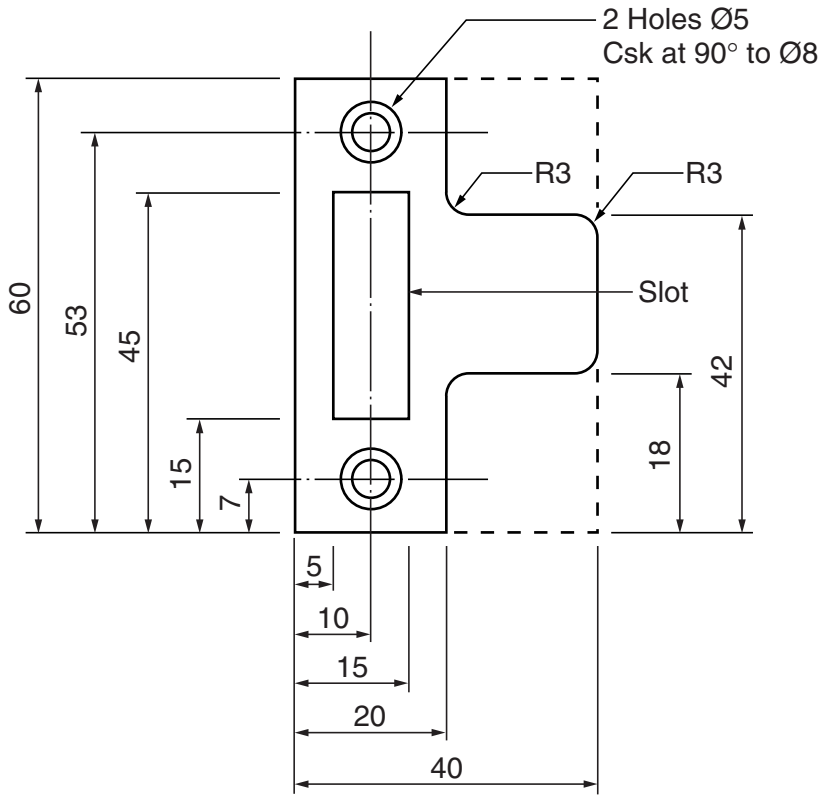


Fig. 1

(a) Show, with the aid of sketches and naming all the tools required, how to mark out:

(i) the slot;

(ii) the holes;

(iii) the profile (i.e. the outline shape) of the catch plate. [9]

(b) Describe with the aid of sketches **two** different methods of removing the bulk of the waste from the slot. [4]

(c) By means of a labelled diagram show how to set up the catch plate in preparation for drilling the two Ø5 holes. [4]

[Turn over

3 **(a)** Give a reason for carrying out the following actions when cutting an external thread:

(i) all the three adjusting screws undone;

(ii) the named side of the die placed outwards in the diestock;

(iii) centre screw located in the split and screwed in to locate the die;

(iv) a bevel filed on the end of the rod to be threaded;

(v) rod set vertically in the vice;

(vi) diestock turned 360° clockwise and then reversed through 90°;

(vii) a check made to ensure die face is at 90° to the rod;

(viii) die stock removed and depth of thread checked;

(ix) centre screw in diestock loosened and side screws tightened before rethreading the rod again. [12]

(b) **(i)** Give **two** reasons for using a lubricant when threading.

(ii) Copy the table shown below and select the most appropriate lubricant from the following:

none, paraffin, soluble oil, water.

MATERIAL	LUBRICANT
Aluminium	
Brass	
Steel	

[5]

4 Fig. 2 shows a pictorial view of a casting made from aluminium alloy.

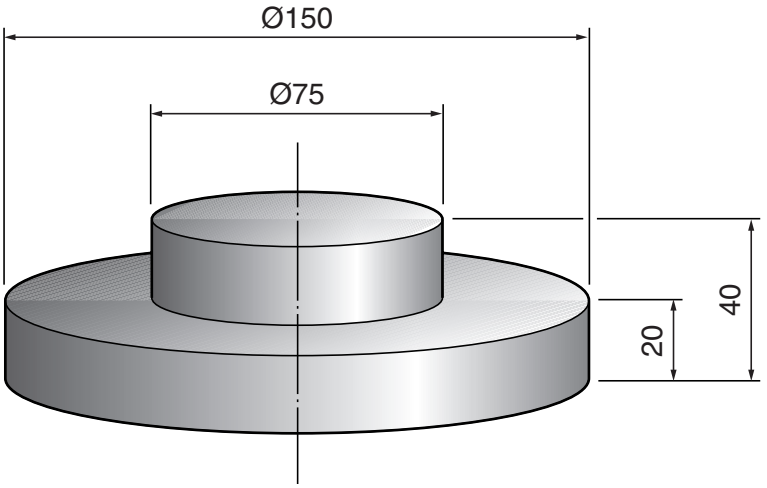


Fig. 2

(a) Draw an elevation of the pattern that would be needed to produce the casting. It is to be held easily in a 3-jaw chuck for accurate machining. Give reasons for any difference between the casting and the pattern. [10]

(b) When sand casting aluminium alloy, it is essential that the correct equipment is used and the correct procedures are followed. Give the likely results in the following situations:

(i) ungraded sand used instead of moulding sand;

(ii) wet moulding sand used;

(iii) excessive ramming of mould;

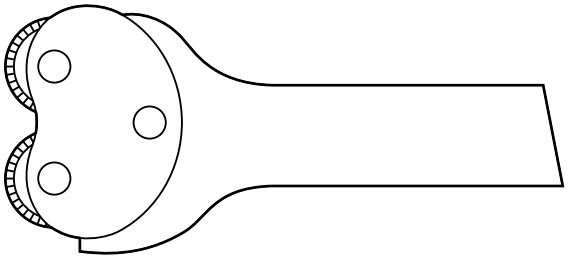
(iv) mould not vented;

(v) unidentified alumium alloy used;

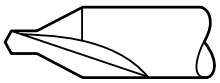
(vi) no flux used;

(vii) very slow pouring of the molten alloy. [7]

5 Six tools used on the lathe are shown below and labelled **A** to **F**.



A



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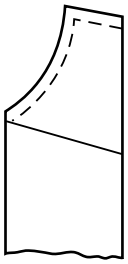
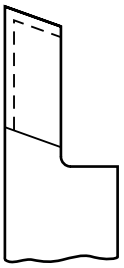
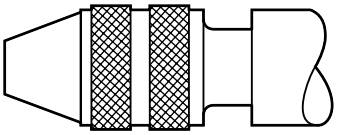


C



D



E

F

Give the name of each tool and, with the aid of sketches, describe a situation where each tool would be used. [17]

Section B

Drawing and Design

Figs. 3, 4 and 5 show incomplete details of a mirror stand made from aluminium alloy.

6 To the right of the line on your paper make a series of sketches leading to the solution of the design problems below. **Brief** notes should be added to identify details such as important sizes and specific materials. It should be possible for the examiner to understand your solutions from these sketches.

In order to solve the problems you may incorporate additional parts and make minor modifications to the given components. Methods of assembly should **not** include welding, brazing or the use of adhesives.

Design Problems

(a) A method of securely attaching the Ø12 column to the mirror base.

(b) A means of allowing the mirror frame to pivot between 0°–30° from the Ø12 column to the back of the mirror as shown in Figs 4 and 5.

(c) A method of easily locking the mirror in position once the correct angle has been selected.

7 Draw full size in 1st or 3rd angle projection the following views of the mirror stand complete with your solutions to the design problems in Question 6:

(a) a front elevation in the direction of arrow **E** (from the back of the mirror);

(b) a sectional end view in the direction of arrow **S**.

Mark allocation	
Communication	[24]
Design	[25]

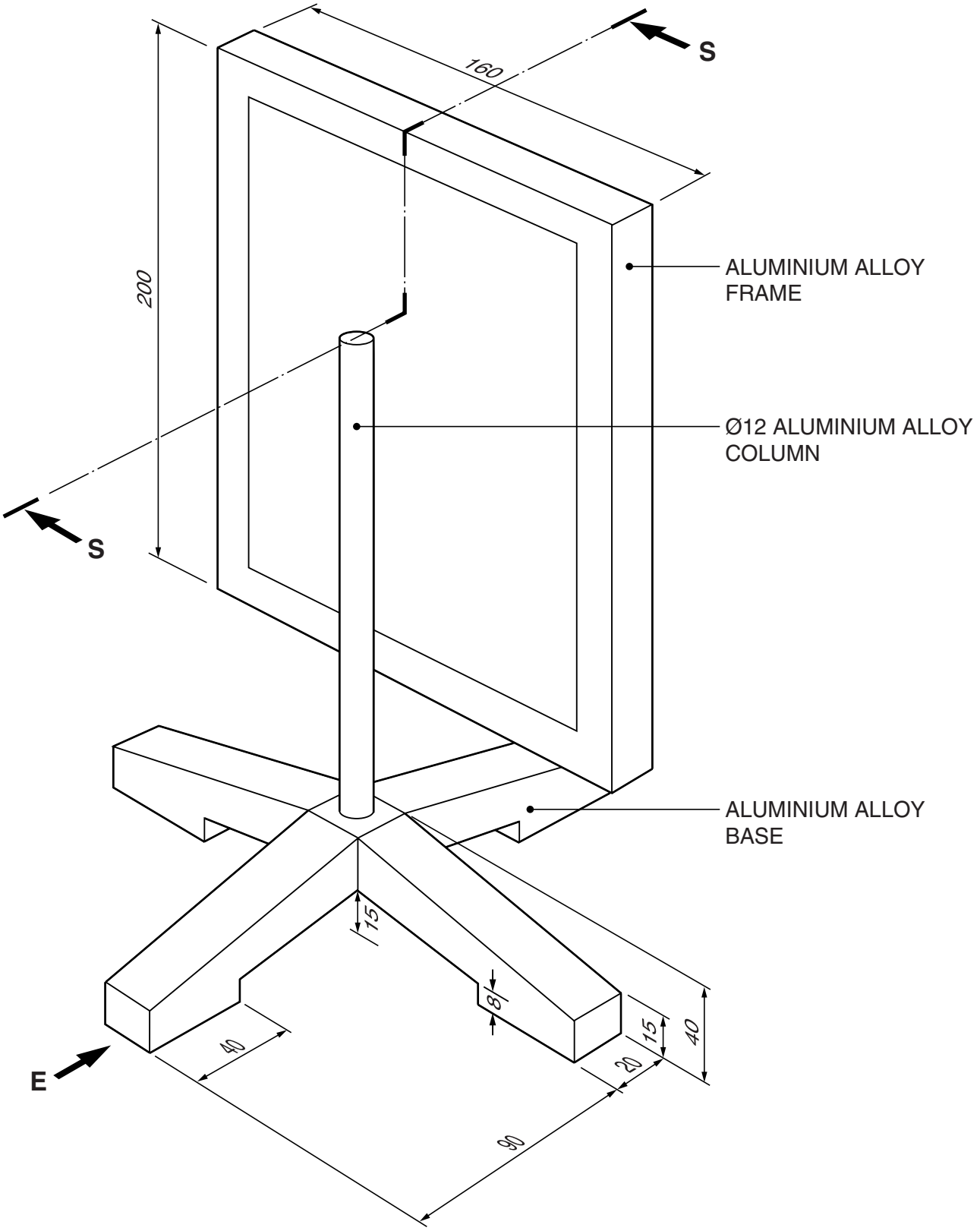
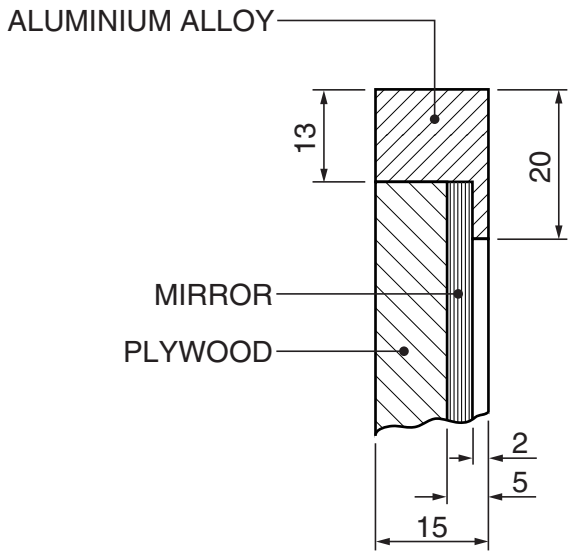

S
160
200
ALUMINIUM ALLOY
FRAME
Ø12 ALUMINIUM ALLOY
COLUMN
S
ALUMINIUM ALLOY
BASE
15
8
40
15
40
20
90
E

Fig. 3



SECTION THROUGH FRAME

Fig. 4

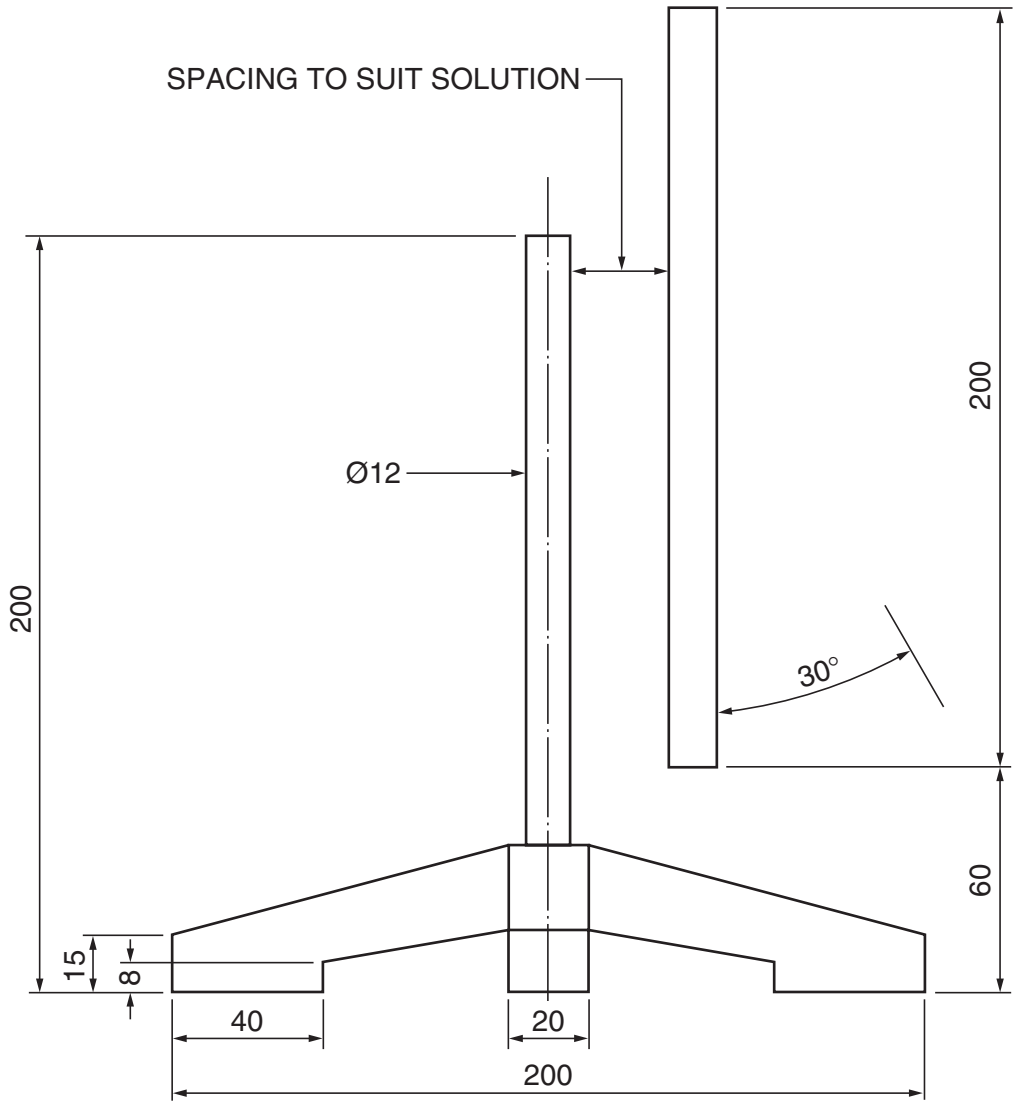


Fig. 5

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