

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
**General Certificate of Education Advanced Level**  
**DESIGN AND TECHNOLOGY**  
**PAPER 3**

**9705/3**

**MAY/JUNE SESSION 2002**

2 hours 30 minutes

Additional materials:  
Answer paper  
A3 Drawing paper (5 sheets)  
A range of design drawing equipment

**TIME** 2 hours 30 minutes

**INSTRUCTIONS TO CANDIDATES**

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

**Section A**

Answer any **two** questions from **one** of the Parts **A**, **B** or **C**.

**Section B**

Answer **one** question.

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets [ ] at the end of each question or part question.

All dimensions are in millimetres.

The instruction 'discuss' denotes that you should:

- examine critically the issues raised by the question;
- explain and interpret these issues as appropriate;
- introduce evidence wherever possible to support conclusions of arguments.

---

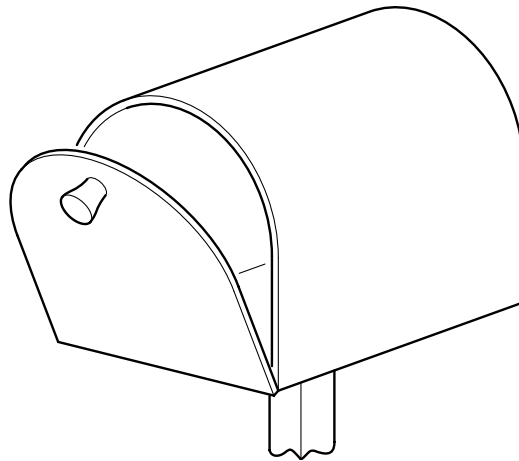
**This question paper consists of 11 printed pages and 1 blank page.**

## Section A

Answer **two** questions from **one** of the Parts **A**, **B** or **C**.

### Part A – Product Design

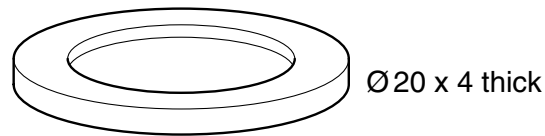
- 1 Fig. 1 shows the design of a mail box.



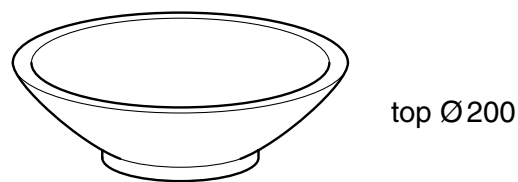
**Fig. 1**

- (a) State a suitable material for the main body of the mail box, giving reasons for your choice. [3]
- (b) Describe using notes and sketches how you would make a prototype mail box body. [8]
- (c) Explain what changes may be necessary in the manufacturing method used and the material selected if 500 mail box bodies were required. Use sketches and notes to support your answer. [9]
- 2 Designers often use 2D and 3D models when designing.
- (a) Describe, using examples, how **two** of the following are used to help a designer:
- construction kits;
  - mock-ups;
  - scale prototypes. [8]
- (b) Use examples to explain how a designer would use a computer to model ideas. [12]

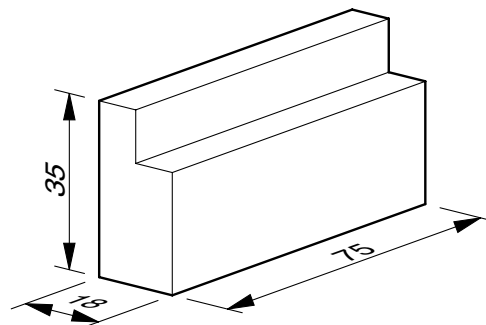
- 3 plastic counter  
process: injection moulding



- wooden fruit bowl  
process: turned on lathe



- mild steel vice jaw  
process: milled



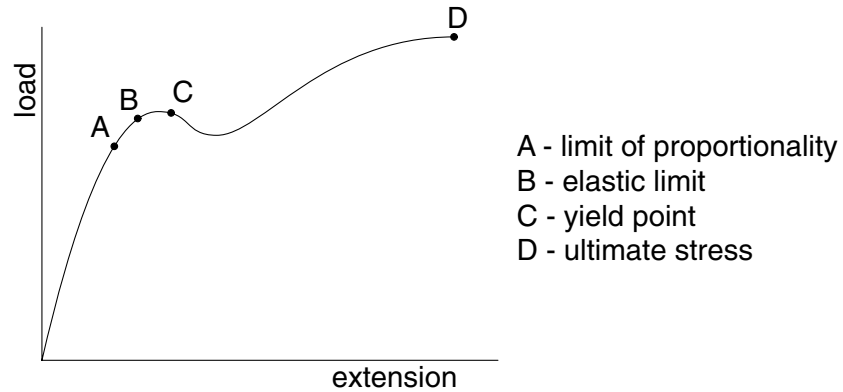
**Fig. 2**

Choose **two** of the items shown in Fig. 2 and for each:

- (a) use sketches and notes to describe the process that relates to the chosen item; [7 x 2]  
(b) explain why the process is particularly suitable for the production of the item. [3 x 2]

## Part B – Practical Technology

4 Fig. 3 shows a load/extension graph for mild steel.



**Fig. 3**

(a) Describe the following features of the graph:

- elastic limit;
- yield point;
- limit of proportionality;
- ultimate stress.

[8]

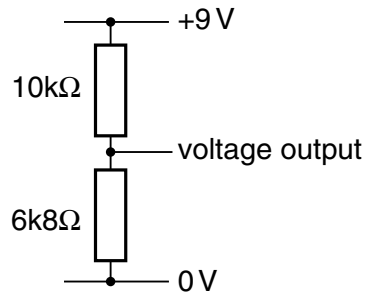
(b) Use sketches and notes to describe a method of comparing the tensile strength of materials. Give details of the samples used and show how comparative measurements can be made.

[12]

- 5 (a) Describe the function and explain the working of the following components.

Give an application of each.

- (i) Reed switch. [4]  
 (ii) Relay. [5]  
 (iii) Darlington Pair. [5]



**Fig. 4**

- (b) Showing all calculations, work out to two decimal places the voltage output for the potential divider shown in Fig. 4. [4]  
 (c) Name and draw a single device that could replace the two resistors in Fig. 4 to achieve the same output voltage. [2]

6 Fig. 5 shows a bench guillotine.

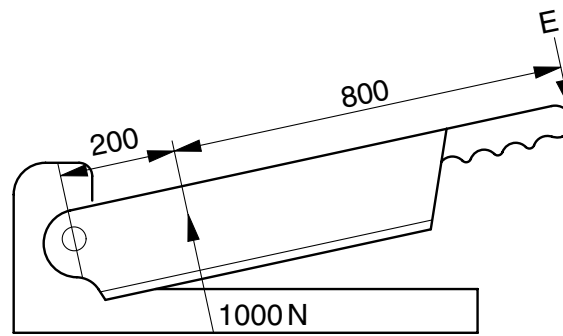


Fig. 5

(a) Calculate the effort E needed to supply the shearing force of 1000 N. [2]

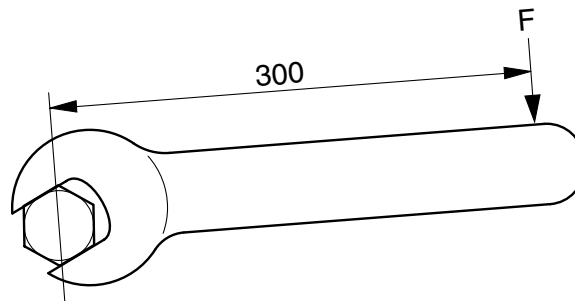


Fig. 6

(b) Find the force F needed at the end of the spanner to exert a turning force of 6 Nm on the nut shown in Fig. 6. [2]

(c) Explain the following terms in relation to mechanisms:

- velocity ratio;
- efficiency. [6]

(d) (i) Use **two** examples to explain how friction can be useful in some mechanisms. [4]

(ii) Use **two** examples to show how friction can be reduced in mechanisms. [6]

Part C – Graphic Products

7 Fig. 7 shows a full size orthographic drawing of a study lamp.

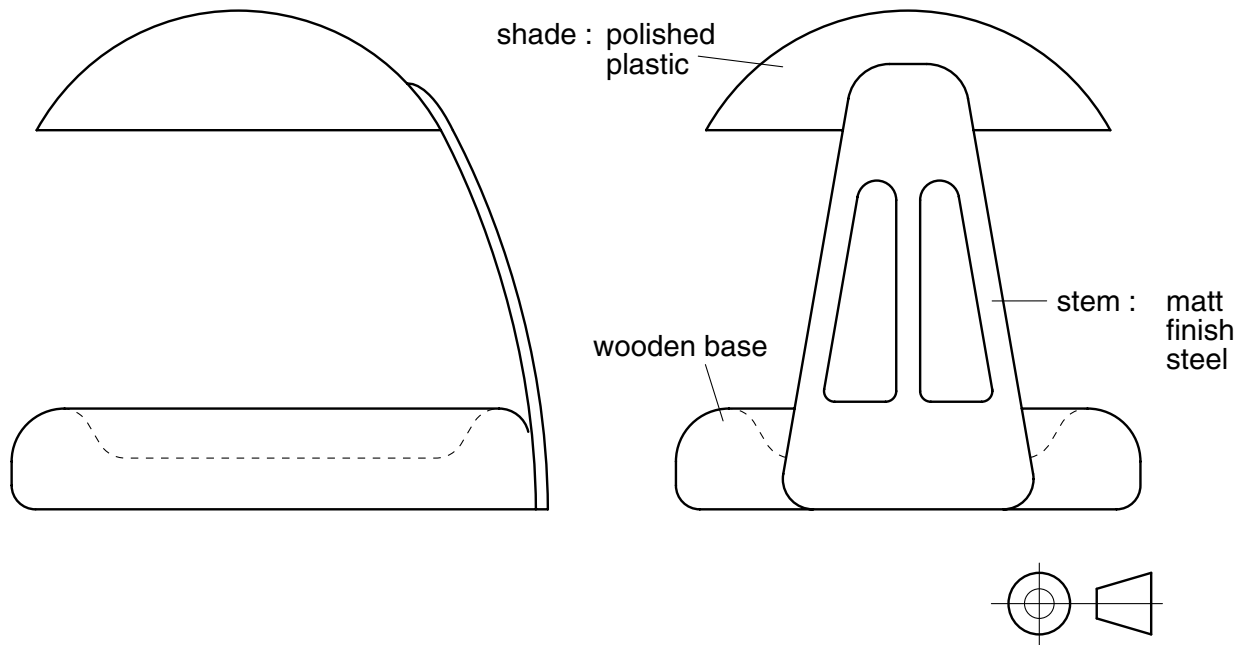


Fig. 7

Draw approximately twice full size a pictorial presentation drawing of the study lamp.

Render the drawing to show that the base is made of wood, the stem of matt finish steel and the shade of polished plastic. [20]

8 The increased use of Information and Communications Technology has had a great impact on designing and manufacturing.

Discuss how computers have influenced:

- the design of products;
- the manufacture of products;
- communication and business efficiency. [20]

9 Some students wish to produce Graphic Products information sheets to be used for examination revision which can be accessed easily on the school website.

Set out a draft which will explain:

(a) the function and application of simple cams; [8]

(b) details of how to construct a simple cam from given data and draw its displacement diagram. [12]

**Section B**

Answer **one** question on the A3 paper provided.

You should approach the design question of your choice in the following manner:

**Analysis**

Produce an analysis of the given situation/problem, which may be in written or graphical form. [5]

**Specification**

From the analysis produce a detailed written specification of the design requirements. [5]

**Exploration**

Use bold sketches and brief notes to show your exploration of ideas for a design solution, with reasons for selection. [25]

**Development**

Show using bold sketches and notes, the development, reasoning and composition of ideas into a single design proposal. Give details of materials, constructional and other relevant technical details. [25]

**Proposed solution**

Produce drawings of an appropriate kind to show the complete solution. [15]

**Evaluation**

Give a written evaluation of the final design solution. [5]

[Total : 80]



10 A playgroup has been opened for 4–6 year olds. It requires toys and equipment for the children to play with.

Design a toy vehicle that is capable of:

- safely seating one child;
- being powered by the child (no motors or engines);
- being steered by the child;
- being stopped easily by the child.

To assist you in your design work anthropometric data is given in Fig. 8.

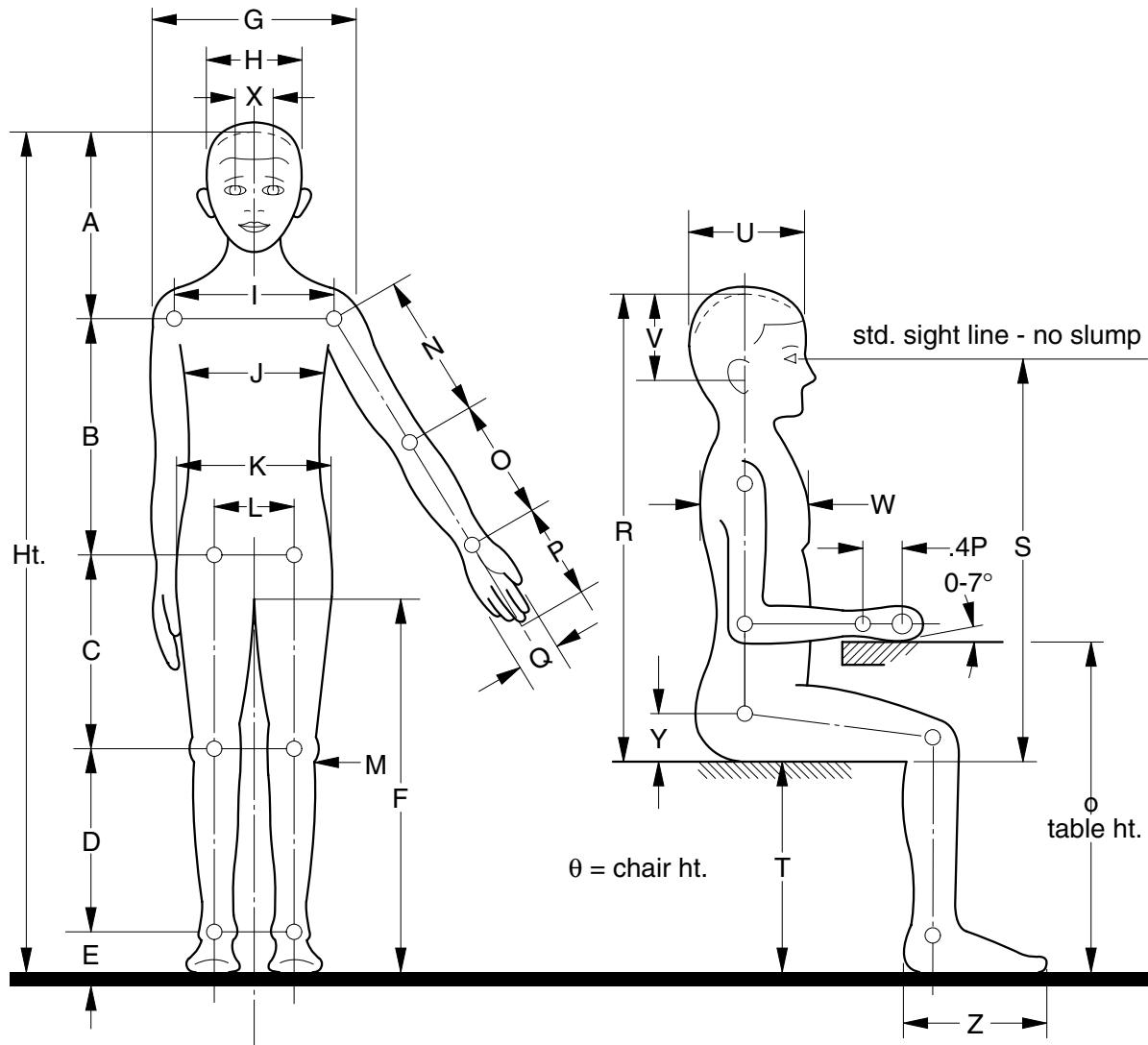


Fig. 8

The top figure in each box is data for boys, the lower figure is for girls and where there is one figure this applies to both.

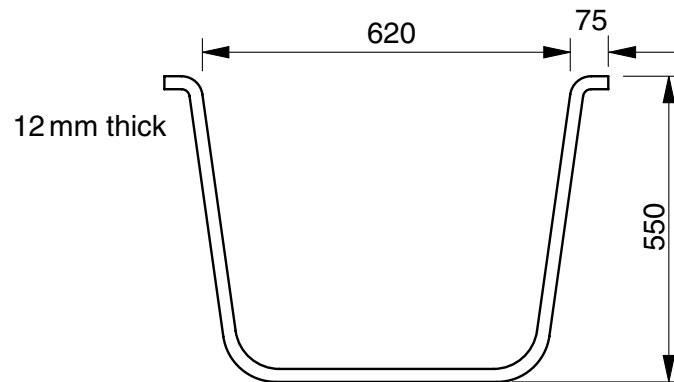
Age	Ht. (mm)	Wt. (kg)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	θ	Ø
6	1152	22	267	318	258	245	63	505	260	142	212	212	208	103	70	190	153	128	58	635	535	288	178	125	138	50	60	175	275	463
	1145	21	258						255	138			210			155			625	525	275	173	124	135						
5	1098	19	254	323	244	234	60	480	255	142		208	203		69	178	152	124		622	521	275	175	124	137	50	58	173	168	
	1090		246					478	249	137			206			150	122		617	516	254	173	122	132	48	60	168		254	445
4	1023	17	260	282	224	213	55	437	246	142		201	188		69	163	142	119		597	495	241	173	124	48	58	168			
			263	277		216			239	137			196			117	117			587	485	254	170	122	132	48	58	165		

- 11 Helpers from a local home for the elderly have contacted your school to help them solve a problem concerning bathing arrangements for the residents.

You have been asked to design an alarm that can be attached to a bath and will:

- sense and warn helpers that a set water level is reached;
- sense and indicate that the water temperature is either: too cold; acceptable; too hot;
- be produced in a batch of 20.

Fig. 9 shows details of the bath.



**Fig. 9**

**12** A sports competition named 'Sports for All' is attended by all of the local schools.

The events include:

- netball;
- volleyball;
- football;
- basketball;
- tennis;
- field and track athletics.

You are to design the following:

- a layout for an A4 poster to advertise 'Sports for All' day;
- a different monochrome logo/symbol for each of any **three** of the events listed, to be included on the photocopied certificates to be awarded to competitors;
- a 'Sports for All' trophy, which could be manufactured in the school workshops, that will be awarded to the competitor who has shown the best all round sporting achievement.

