



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education  
Advanced Subsidiary Level and Advanced Level

**DESIGN AND TECHNOLOGY**

**9705/31**

Paper 3

**October/November 2011**

**3 hours**

Additional Materials: Answer Booklet/Paper  
A range of design drawing equipment  
A3 Drawing Paper (5 sheets)



**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.  
Write in dark blue or black pen.  
You may use a soft pencil for any diagrams, graphs or rough working.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

**Section A**

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

**Section B**

Answer **one** 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.

At the end of the examination, fasten all your work securely together.

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

This document consists of **10** printed pages and **2** blank pages.



## Section A

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

## Part A – Product Design

- 1 Fig. 1 shows an outline design for a clock part.

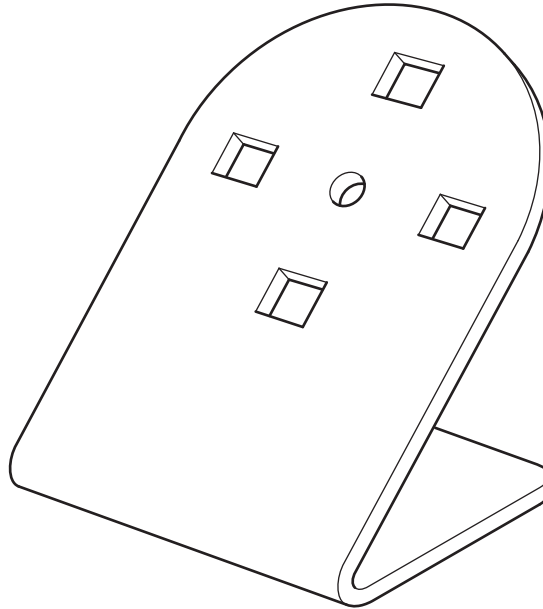
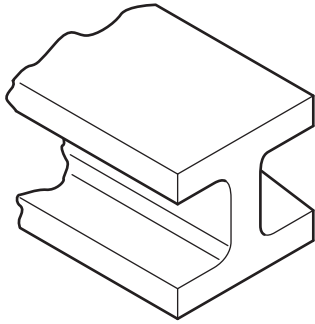


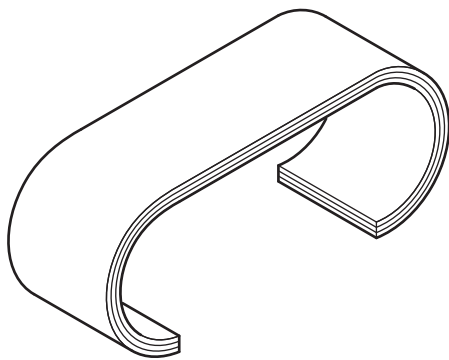
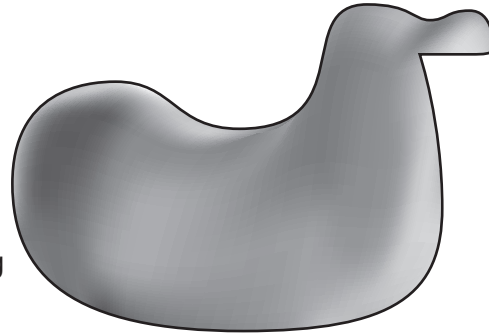
Fig. 1

- (a) State a suitable material for the clock part shown in Fig. 1 and give **two** reasons for your choice. [3]
- (b) Describe, using notes and sketches, how you would make the clock part. [9]
- (c) Explain what changes may be necessary to the design, in the manufacturing method used and in the material selected, if 500 of the clock parts were required. Use notes and sketches to support your answer. [8]
- 2 Heat treatment is the process of heating and cooling metals in a controlled manner, in order to change their properties. Use sketches and notes where appropriate to describe the following heat treatments. In each case, give an example of the use of the process.
- Annealing [5]
  - Hardening [5]
  - Tempering [5]
  - Case Hardening [5]



**item:** 'T' section girder  
**process:** rolling

**item:** sit on rocking toy  
for small children  
**process:** rotational moulding



**item:** table  
**process:** laminating

**Fig. 2**

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

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

## Part B – Practical Technology

- 4 Fig. 3 shows a metal hinge bracket.

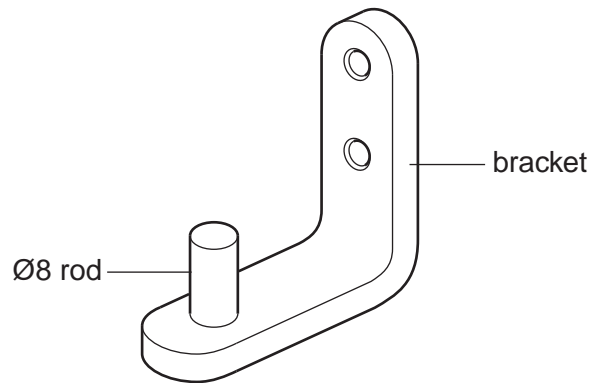


Fig. 3

- (a) Describe, using notes and sketches, the manufacturing stages required if the rod is to be attached to the bracket:
- (i) temporarily; [6]
  - (ii) permanently. [6]
- (b) Using notes and sketches, describe a method of creating a hinge bracket as a one-piece product. [8]

- 5 Fig. 4 shows details of a paint tin lid being opened with a screwdriver.

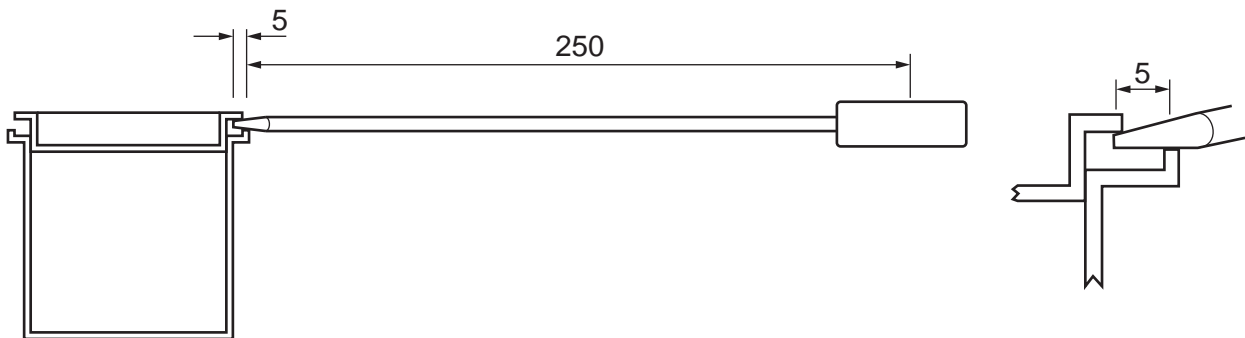


Fig. 4

- (a) The lid offers a resistance of 800 N. Calculate the force that must be applied to the screwdriver to open the lid. [3]
- (b) Fig. 4 can be used as a worked example to explain the term *mechanical advantage*. Use a diagram and appropriate calculations to explain the term *velocity ratio*. [6]
- (c) (i) Draw and label a stress/strain graph for a material of your choice. [3]
- (ii) Describe the key features of the graph and explain their relevance to the design of products. [8]

- 6 (a) Find the output voltage,  $V_{\text{out}}$ , of the circuit shown in Fig. 5.

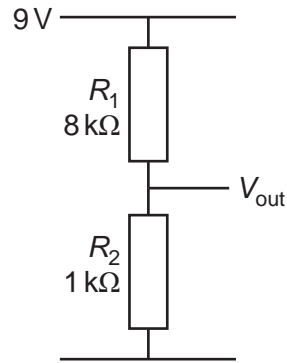


Fig. 5

[3]

- (b) Describe, using an example, the function of the following components:

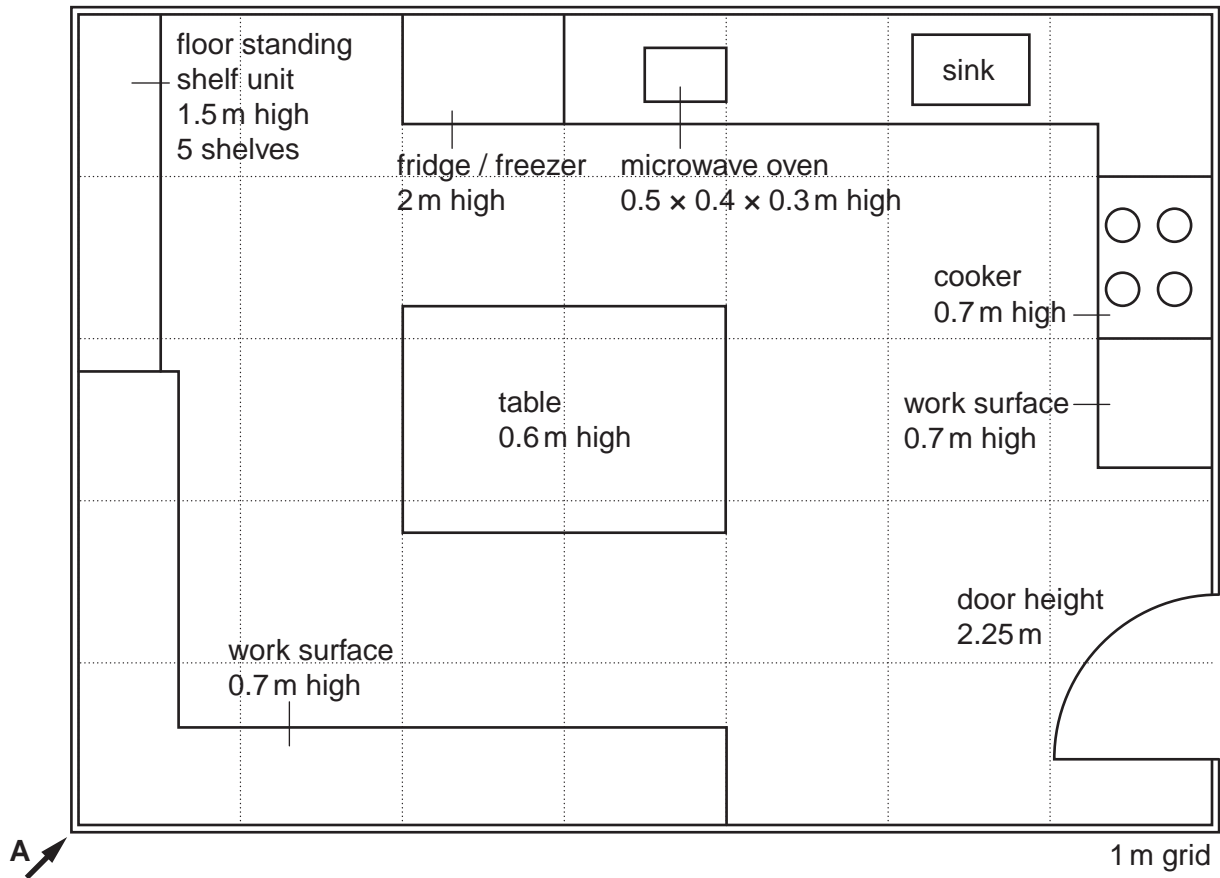
- Schmitt trigger;
- 555 IC timer;
- Transistor.

[9]

- (c) Use notes and sketches to show how mechanisms and/or electronic components can be used in the design of a simple weighing device. [8]

## Part C – Graphic Products

7 Fig. 6 shows the plan of a staff common room.

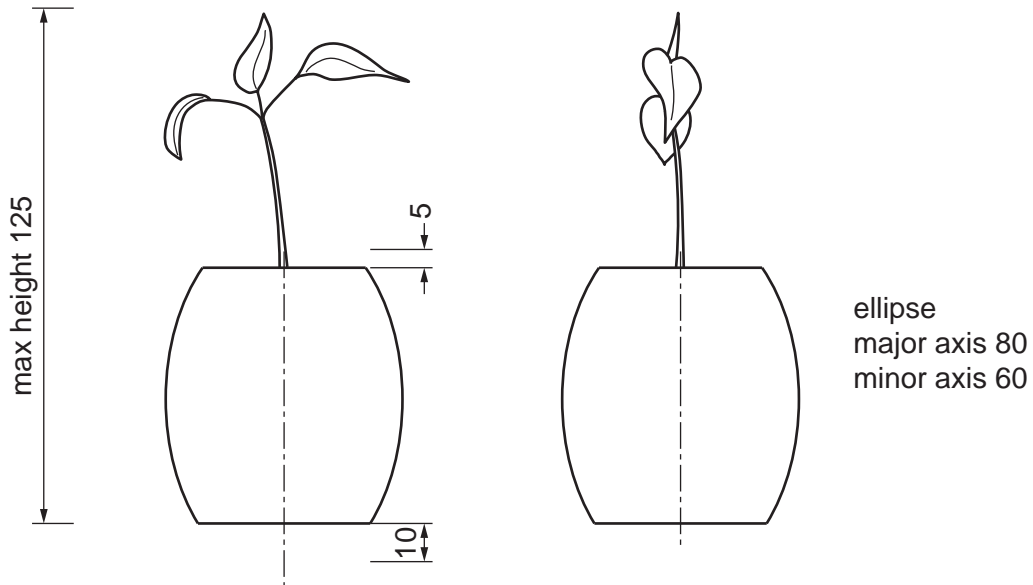


**Fig. 6**

Draw, to an approximate scale, a planometric drawing of the room viewed from arrow **A**.  
Cut away parts of the front walls to ensure that details of the room are clearly visible.

[20]

- 8 Fig. 7 shows a plant and plant holder for which point of sales packaging is required.



**Fig. 7**

- (a) The packaging will be a square-based pyramid in card with a transparent panel on the front face to allow clear visibility of the contents.
- (i) Draw a full size front elevation of the plant holder and plant in its packaging. [5]
- (ii) Construct the development (net) of the packaging. Show all gluing tabs. [10]
- (b) Use sketches and notes to show how the plant holder could be held firmly inside the packaging. [5]
- 9 Discuss the impact of the use of computers and digital technologies on the graphics and print industries. [20]

**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.

Include at least five specification points other than those given in the question. [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]



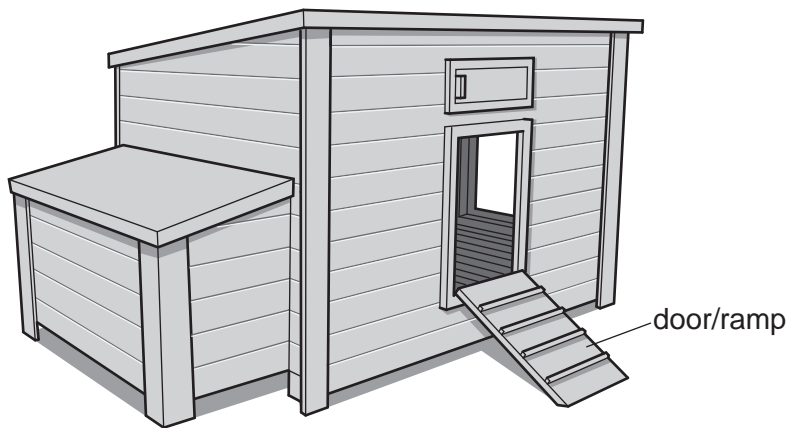
- 10** A jewellery designer wishes to extend their range of high-quality products to include matching sets of jewellery.

Design a matching set of jewellery to consist of a wrist bracelet, ear-rings and a necklace.

- 11** Fig. 8 shows a chicken coop. The door/ramp is hinged and has to be opened and closed manually.

Some owners of chicken coops find it difficult to get up every morning to open and lower the door/ramp to let the chickens out.

Design a system that will automatically open the door and lower it gently for the chickens to get out of the coop.



**Fig. 8**

- 12 A leading manufacturer wishes to introduce a personal digital music system that will include the player, headphones and charger and will have a means of storing the system when not in use.

Design a method of storing the music system when not in use.

Fig. 9 shows details of the player, headphones and charger.

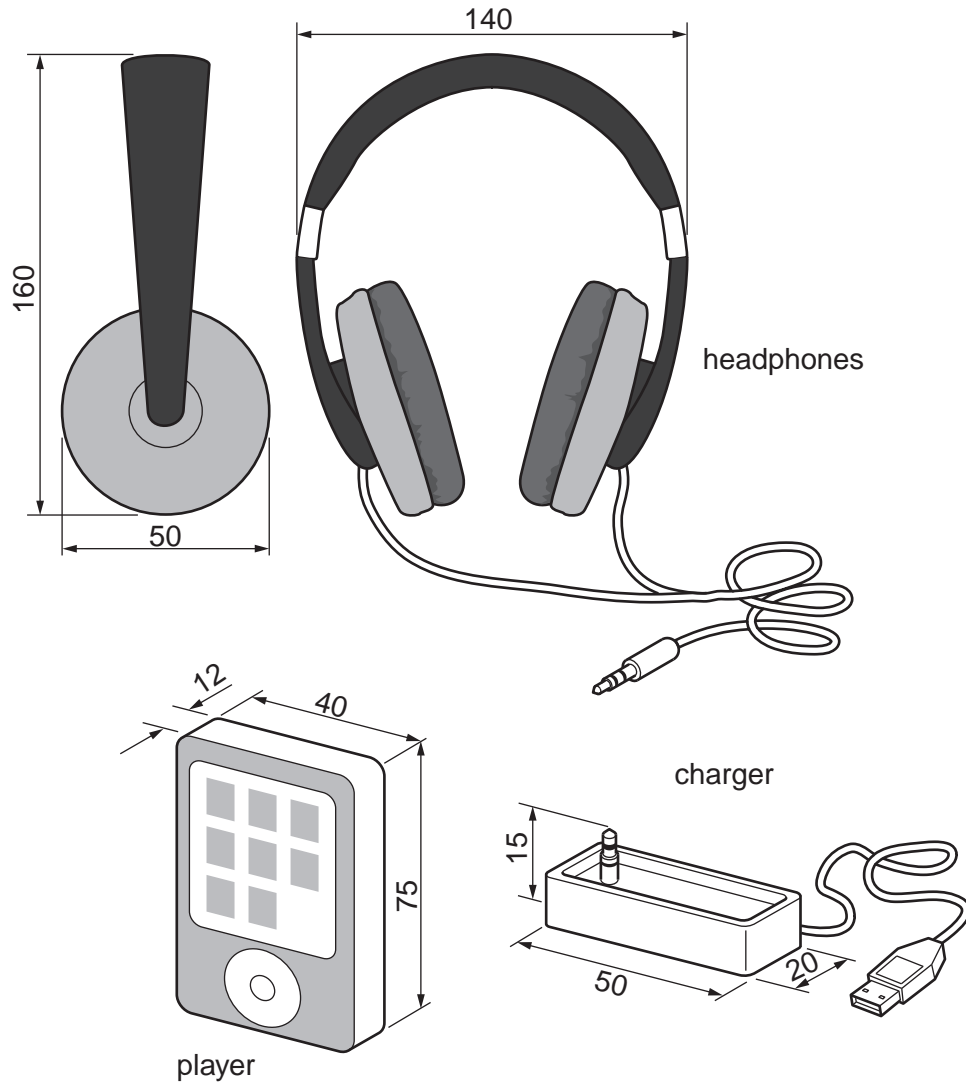


Fig. 9



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