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 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.

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.
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 holder used to display a mobile phone.

(a) State a suitable material for the holder and give two reasons for your choice.  [3]

(b) Describe, using sketches and notes, how you would make the prototype holder.  [8]

(c) Explain what changes may be necessary in the manufacturing method used and in the material selected if 500 holders were required. Use sketches and notes to support your answer.  [9]
2 Fig. 2 shows a cyclist riding a bicycle.

Fig. 2

(a) Identify four examples from Fig. 2, and explain for each, why the designer would have used anthropometric data. [12]

(b) Use examples, other than the use of anthropometric data, to explain two other features of bicycle design that would be influenced by the application of ergonomic principles. [8]
Choose two of the items shown in Fig. 3 and for each:

(a) use sketches and notes to describe the manufacturing 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]
4 (a) Use one example in each case to describe how the following are used to test the performance of materials and/or prototypes:

(i) strain gauge; [3]
(ii) photoelasticity. [3]

(b) (i) Give an example of a material that has good torsional strength and state an appropriate product application. [2]
(ii) Give an example of a material that has good tensile strength and state an appropriate product application. [2]

(c) Discuss the importance of non-destructive testing in the development of new products. [10]

5 Fig. 4 shows a loaded beam.

\[\begin{align*}
R_1 & \quad 5 \text{kN} \quad 7 \text{kN} \quad 4 \text{kN} \\
2 \text{m} & \quad 3 \text{m} \quad 2 \text{m} \\
10 \text{m} & \\
R_2 &
\end{align*}\]

(a) Determine the reactions at $R_1$ and $R_2$. [8]

(b) Problems caused by friction can occur in products that contain moving parts. Discuss the design issues of providing lubrication for the following products:

(i) domestic electric food mixer;
(ii) bicycle;
(iii) car engine. [12]
6 (a) Explain in detail how the following components work:

(i) reed switch; [3]
(ii) relay. [3]

(b) Describe an appropriate application for each component. [2 x 2]

(c) Draw a complete circuit diagram for each application. [5 x 2]
Fig. 5 shows a plan view of the design of a ‘Coffee Shop’ to be used by senior students in a school.

Fig. 5

Draw to an approximate scale, a planometric view of the ‘Coffee Shop’. Draw the planometric view from the direction of arrow A.

[20]
8 Discuss the implications of the increased use of computers when:

- designing products;  
- managing and controlling the manufacture of products.

9 Designers use a range of methods to record and present information.

(a) Use an example for each to explain the use of:

(i) pictograms;
(ii) pie charts;
(iii) flow charts;
(iv) graphs.

(b) Fig. 6 shows orthographic views of a toy train.

Draw a freehand pictorial view of the train.
Render the boiler to show that it has been made from wood.
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]
Children aged 5-11 years are planning a ‘Conservation Week’ looking at a range of environmental issues. You have been asked to help in the design and manufacture of a simple device to crush aluminium cans for recycling.

Design a device that can be easily and safely:

- operated;
- secured to a desk top.

To assist you in your design work, anthropometric data is given in Fig. 7. Details of the desk top are given in Fig. 8. Details of the size of a can are given in Fig. 9.
Many teachers find that the teaching of the basic principles of electricity and electronics to children (11-14 years of age) can be made more interesting and effective if the children can carry out practical experiments.

Design a kit (for one child) which will assist the teacher in the teaching of parallel and series circuits that:

- can be easily and safely used by an 11-14 year old;
- will excite and interest young students;
- is housed in a compact and easy to check form.

A school requires a display system to exhibit coursework of Design and Technology students. The display system is to be used on Open Evenings for parents.

Design an inter-linked display system that will:

- consist of four boards, each being able to display up to six sheets of A3 paper;
- include an area for two examples of practical project work;
- be easily assembled to form a stable display;
- have a life expectancy of at least three years.