CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Level

MARK SCHEME for the October/November 2015 series

9705 DESIGN AND TECHNOLOGY

9705/31 Paper 3, maximum raw mark 120

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

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Section A

Part A – Product Design

1 (a) Suitable material:
– appropriate hardwood for laminating/bending
– aluminium
– stainless steel
– abs/polypropylene/acrylic/HIPS [1]

reasons:
– can produce high quality finish
– can be easily bent to shape
– looks good in a bathroom
– easy to clean

[2 × 1]

(b) Description to include:
quality of description:
– fully detailed 3–7
– some detail 0–2

quality of sketches up to 2 [9]

(c) Explanation could include:
– change in process
– change in materials
– use of jigs, formers, moulds
– simplification of design.

quality of explanation:
– logical, structured 4–6
– limited detail 0–3

quality of sketches up to 2 [8]

[Total: 20]

2 Discussion could include:
– consumer need for product
– speed of response/lead time to sales
– quantity consideration/batch production
– competition/advertising

examination of issues
– wide range of relevant issues 5–9 [9]
– limited range 0–4

quality of explanation
– logical, structured 4–7 [7]
– limited detail 0–3

supporting examples/evidence
– specific products
– specific company promotions
– specific details of quantity production methods [4]

[Total: 20]

3 **(a)** Description of process
– fully detailed 3–5
– some detail 0–2

quality of sketches up to 2 7 × 2 [14]

(b) GRP
– complex curved shapes made
– very strong
– any colour/finish

turning
– accuracy
– all operations on one machine
– high quality finish

corner joint, (could be bridle, dowel, haunched mortise and tenon or other suitable response)
– mechanical strength
– good gluing area
– attractive joint 3 × 2 [6]

[Total: 20]

Part B – Practical Design

4 (a) (i) Force at B

$800 \times 40 = B \times 80$ 1

$B = \frac{32000}{800}$ 1

$B = 400\,N$ 1 [3]

(ii) Force at A

forces must be equal 1

$B + 800 = A$ 1

$A = 1200\,N$ 1 [3]

(iii) move bolt (1) nearer work-piece (1) [2]

(b) Explanation to include:

– details of sand casting up to 4

– details of die casting up to 4

– clear, fully detailed 3–4

– some detail 0–2

suitability up to 2

quality of sketching up to 2 [12]

[Total: 20]

5 (a) (i) mechanism could be: piston

correct mechanism 1

clear sketch 1 [2]

(ii) mechanism could be: worm wheel

correct mechanism 1

clear sketch 1 [2]

(b) (i) Hardness – resistance to indentation or abrasion
Stiffness – ability of a material to resist bending or deflection when a load is applied (ratio of the force required to create a specified deflection)
Tensile strength – The resistance of a material to longitudinal stress, measured by the minimum amount of longitudinal stress required to rupture the material

1×2 [2]

(ii) quality of description and communication: up to 4 4×2 [8]

(iii) strain gauge

description up to 2

reference to testing 1

photo elasticity

description up to 2

reference to testing 1 [6]

[Total: 20]

6 **(a)** If the current flows in only one direction it is called direct current or d.c. 1
Batteries and cells supply d.c. electricity. 1 [2]

If the current constantly changes direction, it is called alternating current or a.c. 1
Mains electricity is an a.c. supply. 1 [2]

(b) **(i)** $I = \frac{V}{R}$ (1) $= \frac{36}{3}$ $= 12\,A$ (1) [2]

(ii) $P = IV$ (1) $= 12 \times 36 = 432\,W$ (1) [2]

(c)

Component 1	Thermistor	1
Component 2	Transistor	1
Component 3	Light Dependent Resistor (LDR)	1

A Thermistor is a sensor; a type of resistor whose resistance varies significantly with temperature.
Thermistors can be used as general temperature sensors;
– current limiters – computer fans (sense overheating),
– self-resetting overcurrent protectors on projectors (switches off projector when heat reaches limit)

A Transistor is a device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal.
Transistors often used as switches
– light switch, power supply – base voltage rises the emitter and collector currents rise exponentially. The collector voltage drops because of reduced resistance from collector to emitter.
Transistors used as an amplifier
– TVs, mobile phones – a small change in voltage changes the small current through the base of the transistor

A LDR or Light Dependent Resistor is a light/dark sensor. Normally the resistance of an LDR is very high, sometimes as high as 1 000 000 ohms, but when they are illuminated with light resistance drops dramatically.
LDR –street lights, fridge /cupboard lights – detects change in light intensity to switch circuit

identification (1) clear description (2) of application (1) [3 × 4]

[Total: 20]

Part C – Graphic Products

7 **Exploded drawing** – an exploded drawing is a diagram, picture or technical drawing of an object, that shows the relationship or order of assembly of various parts

Cut–away drawing – a 3D graphics, drawing, diagram and/or illustration, in which some surface elements of a three–dimensional model are selectively removed, to make internal features visible.

Full size prototype – a full size prototype is a full size early sample, model or release of a product built to test a concept or process to evaluate and learn from.

Computer simulation – or computer model is a computer program that attempts to simulate an abstract model of a particular system or run a process to test validity.

Quality of explanation of each	[5 × 3]
Example	[1 × 3]
Cogency and structure	[2]

[Total: 20]

8

correct isometric	[2]
Overall layout/positioning	[3]
Circle top adjuster	[3]
Circle bottom adjuster	[3]
Jaw left	[2]
Jaw right	[2]
Threaded bars	[2]
Quality of line/construction	[3]

[Total: 20]

9

Correct planometric/positioning	[3]
Table	[3]
L shaped work top	[3]
Worktop	[2]
Shelf	[1]
Window	[2]
Door	[1]
Cabinet	[2]
Sink	[1]
Quality/communication	[2]

[Total: 20]

Section B

Analysis
Analysis of the given situation/problem. [0–5]

Specification
Detailed written specification of the design requirements.
At least five specification points other than those given in the question. [0–5]

Exploration
Bold sketches and brief notes to show exploration of ideas for a design solution, with reasons for selection.
- range of ideas [0–5]
- annotation related to specification [0–5]
- marketability, innovation [0–5]
- evaluation of ideas, selection leading to development [0–5]
- communication [0–5]

Development
Bold sketches and notes showing the development, reasoning and composition of ideas into a single design proposal. Details of materials, constructional and other relevant technical details.
- developments [0–5]
- reasoning [0–5]
- materials [0–3]
- constructional detail [0–7]
- communication [0–5]

Proposed solution
Produce drawing/s of an appropriate kind to show the complete solution.
- proposed solution [0–10]
- details/dimensions [0–5]

Evaluation
Written evaluation of the final design solution. [0–5]

[Total: 80]