

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
GCE Advanced Level

**MARK SCHEME for the October/November 2011 question paper
for the guidance of teachers**

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 must be read in conjunction with the question papers and the report on the examination.

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Section A

Part A – Product Design

1	(a) appropriate material including: <ul style="list-style-type: none"> – Laminated specific hardwood – Acrylic / HIPS – Aluminium/copper 	1	
	Reasons including: <ul style="list-style-type: none"> – Bend to shape easily – Attractive – Easy to cut shapes out 	2 × 1	[3]
	(b) description to include: quality of description: <ul style="list-style-type: none"> – fully detailed – some detail, quality of sketches	3 – 7 0 – 2 up to 2	[9]
	(c) explanation could include: <ul style="list-style-type: none"> – change in process; – change in materials; – use of jigs, formers, moulds; – simplification of design. 		
	quality of explanation: <ul style="list-style-type: none"> – logical, structured – limited detail, quality of sketches	4 – 6 0 – 3 up to 2	[8]
			[Total: 20]

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2 annealing	– description and communication – reduces internal stresses/hardness of metals – heat to a given temperature, allow to cool – ex. Before planishing/reduce work hardening	up to 2 up to 2 1	[5]
hardening	– description and communication – improve strength, wear and indentation resistance – cold working / age hardening of al / quench hardening of steels above 7%C – ex. Screwdriver blades, surface plates	up to 2 up to 2	[5]
tempering	– description and communication – carried out after quench hardening to reduce brittleness – heat to lower temp / look for colour changes / quench – ex. Cutting tools / springs	up to 2 up to 2 1	[5]
case hardening	– description and communication – hardening surface of lower C steels / adds carbon creating higher C steel up to .03 – heat steel to above 800C, immerse in carbon rich compound – crankshafts, axles	up to 2 up to 2 1	[5]

5 × 4 [Total: 20]

3 (a) description of process

– fully detailed	3 – 5
– some detail, quality of sketches	0 – 2 up to 2

7 × 2 [14]

(b) rolling

- long lengths of exact section produced
- maximum grain structure
- no wastage

rotational moulding

- large hollow shape
- excellent finish
- minimal wastage – exact amounts used

Laminating

- attractive single shape – no joins
- strong / light structure
- effective use of materials

3 × 2 [6]

[Total: 20]

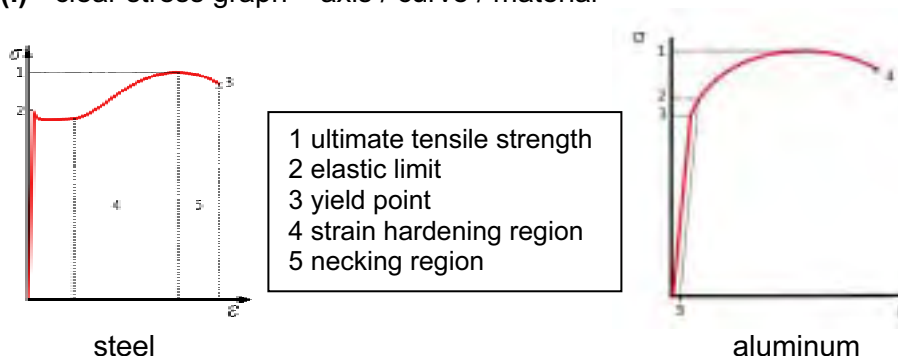
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Part B – Practical Design

- 4 (a) (i) description using temporary method, e.g., screwthread
quality of description and communication:
– fully detailed 4 – 6
– some detail, 0 – 3 [6]
- (ii) description using permanent method e.g. riveting, welding
quality of description and communication:
– fully detailed 4 – 6
– some detail, 0 – 3 [6]
- (b) description of bracket manufactured in one piece e.g. casting
quality of description and communication:
– fully detailed 5 – 8
– some detail, 0 – 4 [8]
- [Total: 20]**

- 5 (a) effort × distance of effort from fulcrum = load × distance of load from fulcrum
= effort × 250 = 800 × 5 (1)
= effort = $\frac{850 \times 5}{250}$ (1) = 16 N (1) [3]
- (b) Velocity ratio – the ratio of the distance moved by the point of application of the effort to the distance moved by the load in a simple machine – distance ratio
clear description up to 2
worked example (including diagram) up to 4 [6]

- (c) (i) clear stress graph – axis / curve / material 1



At least 2 correct features 2 [3]

- (ii) description of at least two features up to 4
Relevance to design up to 4 [8]

[Total: 20]

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6 (a) $V_{\text{out}} = \frac{R_2}{R_1 + R_2} \times \text{supply } V$ 1

$= \frac{1\text{k}\Omega}{8\text{k}\Omega + 1\text{k}\Omega} \times 9\text{V}$

$= 1\text{V}$ 1 [3]

- (b) Schmitt trigger – cleans up analogue device signal
– amplifier
555 IC timer – monostable timer, one stable state
e.g. egg timer
– astable timer, continually changing, on and off
e.g. metronome
Transistor – small current controls larger current
e.g. switching device in circuits
- description up to 2
example 1
3 × 3 [9]

- (c) Answer could include:
- levers, linkages as comparable weighing system
spring / linear potentiometer systems
opto switches/gears
pressure transducer
- quality of response
– detailed, valid use of mechanisms/and or electronic systems 4 – 6
– some detail, one method described 0 – 3
quality of sketches up to 2 [8]

[Total: 20]

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Part C – Graphic Products

7	Correct planometric / quality / scale	4	
	detail	2	
	– work surfaces	3	
	– table	1	
	– door	2	
	– shelf unit	2	
	– cooker	2	
	– sink unit	2	
	– microwave	2	
	– fridge freezer	2	
			[Total: 20]
8	(a) (i) detailed front elevation		
	– pyramid	1	
	– window	1	
	– scale	1	
	– plant holder	2	[5]
	(ii) development		
	– construction	3	
	– window	2	
	– glue tabs	2	
	– accuracy	3	[10]
	(b) appropriate working solution	3	
	communication	2	[5]
			[Total: 20]
9	Discussion could include:		
	– speed		
	– quality/quantity of product		
	– cost implications		
	– training implications		
	– storing/viewing/transferring work		
	examination of issues		
	– wide range of relevant issues	5 – 9	
	– limited range	0 – 4	
	quality of explanation		
	– logical, structured	4 – 7	
	– limited detail	0 – 3	
	supporting examples / evidence		
	– specific computer applications / software		
	– specific print applications		
	– specific products	4	
			[Total: 20]