

**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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Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A LEVEL – October/November 2011	9705	31

Section A

Part A – Product Design

- 1 (a)** appropriate material including:
- Laminated specific hardwood
 - Acrylic / HIPS
 - Aluminium/copper
- 1
- Reasons including:
- Bend to shape easily
 - Attractive
 - Easy to cut shapes out
- 2 × 1 [3]
- (b)** description to include:
- quality of description:
- fully detailed
 - some detail,
- quality of sketches
- 3 – 7
0 – 2
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
 - limited detail,
- quality of sketches
- 4 – 6
0 – 3
up to 2 [8]
- [Total: 20]**

Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A LEVEL – October/November 2011	9705	31

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

5 × 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) 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]

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A LEVEL – October/November 2011	9705	31

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

$$= \text{effort} \times 250 = 800 \times 5 \text{ (1)}$$

$$= \text{effort} = \frac{850 \times 5}{250} \text{ (1)} = 16 \text{ N (1)} \quad [3]$$

- (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

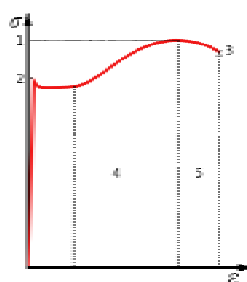
up to 2

worked example (including diagram)

up to 4 [6]

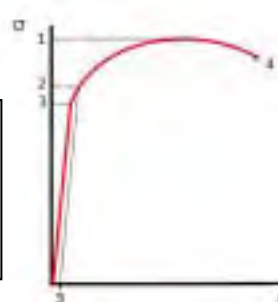
- (c) (i) clear stress graph – axis / curve / material

1



steel

- 1 ultimate tensile strength
- 2 elastic limit
- 3 yield point
- 4 strain hardening region
- 5 necking region



aluminum

At least 2 correct features

2 [3]

- (ii) description of at least two features
Relevance to design

up to 4

up to 4 [8]

[Total: 20]

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A LEVEL – October/November 2011	9705	31

- 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
- 555 IC timer – amplifier
- 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]**

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A LEVEL – October/November 2011	9705	31

Part C – Graphic Products

7	Correct planometric / quality / scale	4	
	detail – work surfaces	2	
	– table	3	
	– door	1	
	– 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]