

**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.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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**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]**

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<b>2 annealing</b>	– 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]
<b>hardening</b>	– 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]
<b>tempering</b>	– 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]
<b>case hardening</b>	– 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]

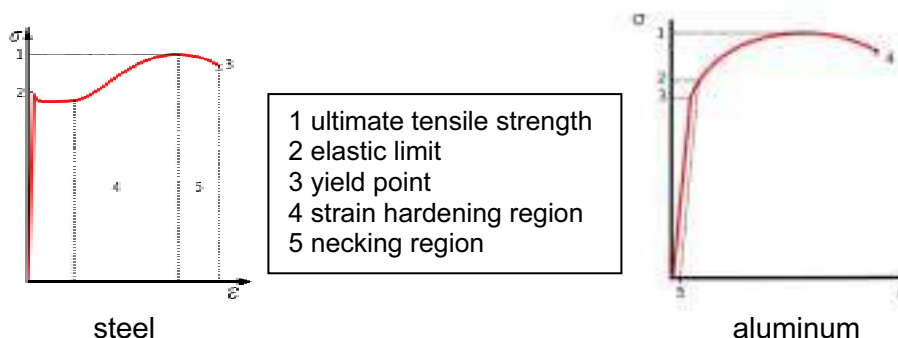
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**Part B – Practical Design**

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

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

$= 1V$  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

<b>7</b>	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	
			<b>[Total: 20]</b>
<b>8</b>	<b>(a) (i)</b> detailed front elevation		
	– pyramid	1	
	– window	1	
	– scale	1	
	– plant holder	2	[5]
	<b>(ii)</b> development		
	– construction	3	
	– window	2	
	– glue tabs	2	
	– accuracy	3	[10]
	<b>(b)</b> appropriate working solution	3	
	communication	2	[5]
			<b>[Total: 20]</b>
<b>9</b>	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	
			<b>[Total: 20]</b>