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.

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UNIVERSITY of CAMBRIDGE
International Examinations

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 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 **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]

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

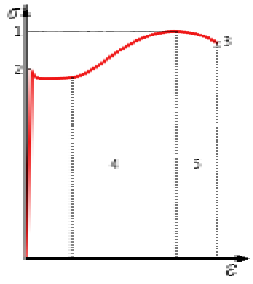
= effort × 250 = 800 × 5 (1)

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

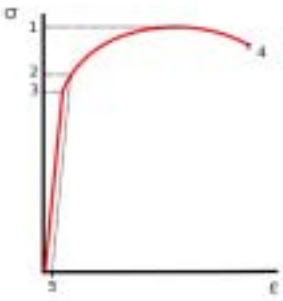
(b) Velocity ratio – the ratio of the distance moved by the point of application of the effort to the distance moved by the load in a simple machine – distance ratio

clear description up to 2
worked example (including diagram) up to 4 [6]

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



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



steel aluminum

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]

6 **(a)** V out = $\frac{R2}{R1+R2}$ × supply V 1

= $\frac{1k\Omega}{8k\Omega+1k\Omega}$ × 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]

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]