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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

AS Design and Technology
Systems and Control Technology
5556

SCT1 Materials and Components

Mark Scheme

2008 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Quality of Written Communication

The following marks are allocated to the quality of the candidate's written communication. Make a separate assessment of the candidate's overall ability as demonstrated across the paper using the criteria given below.

Performance Criteria	**Marks**
The candidate will express complex ideas extremely clearly and fluently. Sentences and paragraphs will follow on from one another smoothly and logically. Arguments will be consistently relevant and well structured. There will be few, if any, errors of grammar, punctuation and spelling.	4
The candidate will express moderately complex ideas clearly and reasonably fluently, through well-lined sentences and paragraphs. Arguments will be generally relevant and well structured. There may be occasional errors of grammar, punctuation and spelling.	3
The candidate will express straightforward ideas clearly, if not always fluently. Sentences and paragraphs may not always be well connected. Arguments may sometimes stray from the point or be weakly presented. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.	2
The candidate will express simple ideas clearly, but may be imprecise and awkward in dealing with complex or subtle concepts. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling may be noticeable and intrusive, suggesting weaknesses in these areas.	1

NB This mark scheme is intended as a guide to the type of answer expected but is not intended to be exhaustive or prescriptive. If candidates offer other answers which are equally valid **they must be given full credit.**

Many responses at this level are assessed according to the **quality** of the work rather than the number of points included. The following level descriptors are intended to be a guide when assessing the quality of a candidate's response.

Low mark range
The candidate has a basic but possibly confused grasp of the issues. Few correct examples are given to illustrate points made. Description may be unclear.

Mid mark range
The candidate has some knowledge but there will be less clarity of understanding. Some correct examples given to illustrate points made. Description better but unclear or confused in parts.

High mark range
The candidate has a thorough understanding of the issues and has provided relevant examples to support the knowledge shown. This candidate's answer shows clear evidence of understanding.

1 (a) (i) Any three valid responses for the use of metal (3 marks)

(ii) Any three valid responses for the use of plastic (3 marks)
Examples:
Plastic straps are lighter than metal
Plastic cases/straps do note need protection from corrosion
Plastic cases/straps can be produced in a wide range of colours
Plastic case/straps can be formed into more complex shapes than metal
Metal cases/straps are stronger than plastic
Metal cases/straps have better visual appeal than that of plastic
Metal cases/straps have better durability than plastic

(b) Any suitable metal e.g. aluminium (1 mark)

(c) (i) Any three valid responses for the use of wood (3 marks)

(ii) Any three valid responses for the use of plastic (3 marks)
Examples:
Wooden window frames are simpler to manufacture than plastic
Softwood timber frames typically cost less than plastic frames
Wooden window frames are more environmentally friendly than plastic
Plastic frames are highly weather resistant
Plastic frames are typically lighter than wooden frames
Plastic frames have a longer life span than softwood frames

(d) Any suitable plastic e.g. uPVC (1 mark)

(e) Any four valid comments briefly made, or two comments discussed in greater depth for each of the two named smart materials (2 x 4 marks)

(f) (i) Velocity Ratio = 1:12 (1 mark)
Calculations showing that this can be made from 80mm/20mm & 60mm/20mm pulleys, or any other valid combination (3 marks)

Correct sketch of compound pulley system (2 marks)

(ii) Velocity ratio = 8:1 (1 mark)
Calculations showing that this can be made from 20mm/80mm & 20mm/40mm pulleys, or any other valid combination (3 marks)

Correct sketch of compound pulley system (2 marks)

(g) Simplistic answer giving basic information on the use of stepper motors and/or toothed belts compared with DC motors and/or flat bells (1-2 marks)

Good answer making specific reference to individual aspects of the use of stepper motors and toothed belts compared with DC motors and flat belts (3-4 marks)

Excellent answer giving in-depth detail of the use of stepper motors and toothed belts compared with DC motors and flat belts (5-6 marks)

Answers could include some of the following points:
Stepper motors move precise distances each pulse
Toothed belts do not slip
Flat belts can slip and come off a pulley
DC motors have backlash in the gearboxes
DC motors are difficult to stop instantaneously
DC motors are electrically 'noisy'
Etc.

40 marks

2 (a) LDR, resistor and centre tapping (3 marks)

LDR correctly positioned, relative to power supply (1 mark)

(b) Correct inclusion of potential divider from part (a) (1 mark)

Suitable automatic switching circuit e.g. Transistor switch circuit, Relay, PIC (with programme) (3 marks)

Method of manual override (1 mark)

Quality of sketch (1 mark)

PIC without programme (1 mark)

(c) (i) Any two valid responses outlining the use of a jig (2 x 2 marks)

Quality of sketch(es) (1 x 2 marks)
E.g. Use of jigs for drilling holes and or folding

(ii) Any two valid responses outlining the use of a template (2 x 2 marks)

Quality of sketch(es) (1 x 2 marks)

E.g. Use of templates to mark out sheet for cutting or holes/cut outs

(d) Any three valid reasons (3 x 2 marks)
E.g.
Discussion of Batch Production could include:
Production can be tailored to demand
Assembly lines can be used to produce a range of different products
Changeover costs will be incurred as assembly lines have to be re-tooled
Storage costs will be incurred as batches of products are used or sold. Etc

Discussion of Mass Production could include;
The design, tooling and setting-up costs can be spread over many items
The selling price can be less than batch or one-off production
Low selling price of mass produced items will lead to increased sales
If production rates match sales rates there will be no storage costs.
Etc.

28 marks

3 (a) Simplistic answer giving basic information on the use of rechargeable batteries as opposed to non-rechargeable batteries in portable electronic products (1-2 marks)

Good answer making specific reference to the advantages and disadvantages of using rechargeable batteries as opposed to non-rechargeable batteries in portable electronic products (3-4 marks)

Excellent answer giving in-depth detail of the advantages and disadvantages of using rechargeable batteries as opposed to non-rechargeable batteries in portable electronic products and the correct use of technical terminology (5-6 marks)

Answers could include some or all of the following points:

Non-rechargeable batteries use toxic chemicals In their manufacture

Non-rechargeable batteries have an environmental cost to their disposal

Non-rechargeable batteries use finite resources in their manufacture

Rechargeable batteries are most cost effective over time

Rechargeable batteries can give higher current outputs

Rechargeable batteries can 'memorise' and loose storage capacity

(b) Simplistic answers give basic information on the social and environmental issues associated with one or more of the three different transport usages (2 x 0-2 marks)

Good answer making specific reference to a number of social and environmental issues associated with one or more of the three different transport usages (2 x 3-4 marks)

Excellent answer giving in-depth detail of a wide range of the social and environmental issues with more than one of the different transport usages and the conflicts and interplay between these issues (2 x 5-6 marks)

Answers could include some or all of the following points:

Social importance of car ownership

More mobile population for both work and leisure

Greater expectation of employees to travel to/from and from work

Traffic congestion in towns and on motorways

Taxation available to governments from road tax and fuel

Beneficial to economy but losses incurred when congestion hits

At root of modern stock control methods and in the service sector

Environmental damage from fuel usage

Noise pollution

Environmental concerns regarding the manufacture and disposal of motor vehicles

Environmental, safety and social issues of the use of bicycles

Etc.

3 (c) Simplistic answer giving basic information on the use of micro-processor control systems to manage traffic flow in towns and cities (1-4 marks)

Good answer making specific reference to individual aspects of micro-processor control systems to manage traffic flow in towns and cities (5-7 marks)

Excellent answer giving in-depth detail of the use of microprocessor control systems to manage traffic flow in towns and cities (8-10 marks)

Answers could include some or all of the following points:
Micro-processor control systems can be used to sequence traffic lights in towns in response to traffic flow

Micro-processor control systems can be used to set up road tolls and congestion charging

Micro-processor control systems can be used to monitor traffic flow and car park use and trigger signs accordingly

Micro-processor control systems can be used to control closed-circuit TV cameras to monitor traffic flow around city centres and inform traffic bulletins on radio

Micro-processor control systems can provide feedback to car satellite-navigation systems and allow them to determine optimal routing

28 marks

4	(a)	(i)	Suitable diagram of a debounced switch circuit E.g. Schmitt trigger/capacitor, RS flip flop, Monostable, PIC with programme	(5 marks)
			Quality of sketch	(1 mark)
			NOT gate without switch debouncing	(up to 3 marks)
		(ii)	Suitable explanation of circuit drawn in part (i). Answers should include the multiple signal nature of the switch and the cleaning of the signal such that only a clean high/low/high or (vice versa) inputs to the circuit that controls the lights.	(4 marks)
		(iii)	Any suitable method of controlling the three lights E.g. Decade counter, PIC with suitable programme. Etc.	(6 marks)
			Quality of diagram	(2 marks)
		(b)	$R_p = V_{supply} - V_{LED})/I_{LED}$	(1 mark)
			$R_p = (9-2)/0.02$	(1 mark)
			$R_p = 7/0.02 = 350\Omega$	(2 marks)
			Correct answer with units (no working)	(4 marks)
			Carry-through errors	(up to 2 marks)
		(c)	Any three valid responses, with explanation comparing the two output devices. E.g. Light bulbs require higher voltages to drive them than LEDs LEDs require much smaller currents to drive them than light bulbs The viewing angle of an LED is much smaller than that of a light bulb The average life of an LED is much greater than that of a light bulb	(6 marks)

28 marks