



General Certificate of Education

Design and Technology:  
Systems and Control Technology  
5556/6556  
SCT 1

**Mark Scheme**

*2007 examination - June series*

For Publication

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.

Further copies of this Mark Scheme are available to download from the AQA Website: [www.aqa.org.uk](http://www.aqa.org.uk)

Copyright © 2007 AQA and its licensors. All rights reserved.

#### COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

### *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.*

<b>Performance Criteria</b>	<b>Marks</b>
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) Any valid explanation of the circuit operation, up to a maximum of 8, including:
- Operation of push switch causes pin 2 on IC1 to go LOW (1 mark)
  - C1 charges via R2 (1 mark)
  - Pin 3 on IC1 goes HIGH (1 mark)
  - for a time given R2 & C1 (1 mark)
  - Q1 switches on allowing IC2 to operate (1 mark)
  - Pin 3 of IC2 oscillates at a frequency determined by R3, 4 & C2 (1 mark)
  - The loudspeaker gives an audible output (1 mark)
  - The sound stops after a period of time (1 mark)
  - The sound can be re-triggered by operating the push switch again (1 mark)
- (b)  $f = 1.44 / (12000 + (2 \times 1000) \times 100 \times 10^{-9})$  (1 mark)
- $f = 1.44 / (14000 \times 1 \times 10^{-7})$  (1 mark)
- $f = 1.44 / 1.4 \times 10^{-3}$  (1 mark)
- $f = 1029 \text{ Hz}$  Accept 1028 to 1030 (2 marks)
- Correct answer with units (no working) (5 marks)
- Carry-through errors (up to 3 marks)
- (c)  $t = 1.1 \times 220000 \times 100 \times 10^{-6}$  (1 mark)
- $t = 24.2 \text{ seconds}$  Accept 24 seconds (2 marks)
- Correct answer with units (no working) (3 marks)
- Carry-through errors (up to 2 marks)
- (d) Any suitable PCB layout highlighting the location of the following, up to a maximum of 12 marks:
- IC1 including identification of pin 1 (2 marks)
  - IC2 including identification of pin 1 (2 marks)
  - R1 – R5 (up to 5 marks)
  - C1 – C3 (up to 3 marks)
  - Switch (1 mark)
  - Loudspeaker (1 mark)
  - Transistor (Q1) (1 mark)
  - + VE power supplies to pins 8 and 4 (up to 4 marks)
  - VE power supplies to pin 1 (up to 2 marks)

- (e)
- (i) Any suitable plastic. E.g. Polystyrene, ABS etc. (1 mark)
- (ii) Suitable annotated sketches and explanation of a suitable process  
e.g. vacuum forming, injection moulding:  
Description of chosen process (up to 5 marks)  
Quality of sketch(es) (2 marks)
- (f) Any two valid comments, with discussion comparing and/or contrasting the two systems (4 marks)

e.g.

Quality control is a method of checking quality against set standards

Quality control occurs after a particular stage in manufacture

Quality control is undertaken by trained inspectors

Quality assurance is a series of planned actions to ensure a product meets given quality standards

Quality assurance takes place at all stages of manufacture

**40 marks**

- 2 (a) Any three suitable input components capable of monitoring the three conditions. E.g.
- (i) Microswitch, Push Switch, Slotted Opto-switch, etc. (1 mark)
  - (ii) Float sensor, Moisture sensor, etc. (1 mark)
  - (iii) Thermistor, etc. (1 mark)
- (b)
- (i) Suitable input circuit using the component identified in part (a(i)) that gives a HIGH output when the door is closed (3 marks)
  - (ii) Suitable input circuit using the component identified in part (a(ii)) that gives a HIGH output when the drum is filled with water (3 marks)
  - (iii) Suitable input circuit using the component identified in part (a(iii)) that gives a HIGH output when the water is at the correct temperature (3 marks)
- (c) Three suitable annotated sketches showing the mounting of the input components that enable the three conditions to be monitored (3 x 2 marks)
- (d) Any suitable electronic logic circuit. e.g.
- Door sensor (1 mark)
  - Water level sensor (1 mark)
  - Temperature sensor (1 mark)
  - Suitable logic gates (2 marks)
  - Output marked (1 mark)
  - Clarity of logic diagram (1 mark)
- Up to a maximum of* (6 marks)
- (e) Suitable truth table for logic circuit in part (d) (4 marks)

e.g.

Door Sensor	Water level sensor	Temperature sensor	Output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

**28 marks**

- 3 (a) Suitable annotated sketch of an appropriate crank and slider mechanism (3 marks)  
Appropriate activation of the switch (1 mark)  
Indication of pivot point between con-rod and slider to give reciprocating motion (1 mark)  
Clarity of sketch (1 mark)
- (b) Any suitable mechanical system of allowing the crank to run at three different speeds from a motor running at a constant speed. E.g. Stepped cone pulleys, gearbox etc. Must be attached to crank for full marks. (5 marks)  
Clarity of sketch (1 mark)
- (c) Any appropriate comparison or contrast, with explanation, between the two mechanisms. (6 marks)  
  
E.g.  
Movement of follower is dictated by cam profile  
Follower requires gravity or a spring to return  
Easier to get larger reciprocating movement from a crank & slider  
Less moving parts to wear on a cam
- (d) Any suitable method of counting 100 operations of the switch-button then stopping the crank. E.g. mechanical, electro-mechanical, electronic, electro-pneumatic, etc  
Method of sensing (1 mark)  
Position of sensor (1 mark)  
Method of counting (2 marks)  
Method of recording count (2 marks)  
Suitable output at count of 100 (1 mark)  
Method of switching off motor (1 mark)  
Clarity of diagram (2 marks)

**28 marks**

- 4 (a)
- (i) Method of production: Any three comments briefly made, or a single comment with explanation discussing the method of production of the coat hanger in wood (3 marks)
- Scale of production: Any two comments briefly made, or a single comment with explanation discussing the scale of production of the coat hanger in wood (2 marks)
- Degree of durability: Any two comments briefly made, or a single comment with explanation discussing the degree of durability of making the coat hanger from wood (2 marks)
- (ii) Any suitable wood (1 mark)
- (b)
- (i) Method of production: Any three comments briefly made, or a single comment with explanation discussing the method of production of the coat hanger in plastic (3 marks)
- Scale of production: Any two comments briefly made, or a single comment with explanation discussing the scale of production of the coat hanger in plastic (2 marks)
- Degree of durability: Any two comments briefly made, or a single comment with explanation discussing the degree of durability of making the coat hanger from plastic (2 marks)
- (ii) Any suitable plastic (1 mark)
- (c)
- (i) Method of production: Any three comments briefly made, or a single comment with explanation discussing the method of production of the coat hanger in metal (3 marks)
- Scale of production: Any two comments briefly made, or a single comment with explanation discussing the scale of production of the coat hanger in metal (2 marks)
- Degree of durability: Any two comments briefly made, or a single comment with explanation discussing the degree of durability of making the coat hanger from metal (2 marks)
- (ii) Any suitable ferrous metal (1 mark)



- (d) Response demonstrates a basic understanding of recycling (0-1 marks)  
Response demonstrates a sound understanding of recycling with reference to the materials (2-3 marks)  
Good response with appropriate reference to the recycling process with relevance to the product and materials (4 marks)

**28 marks**