Version 1.0

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Design and Technology: Electronic Products 3551

Short Course Higher Tier

Mark Scheme

2005 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.

1 **Figure 1 shows a black diagram of a fire alarm.**

(a) **Figure 2 shows a circuit used as part of the system.**

(i) **Give the name that best describes this circuit.**

Astable / Pulse Generator

(1 mark)

(ii) **State which block in Figure 1 is represented by the circuit in Figure 2.**

Pulse generator

(1 mark)

(b) **Calculate the frequency of the circuit.**

Formula should include: Frequency = $\frac{1.44}{(R1 + 2R2) \times C}$ (1 mark)

Working reference to R1 + 2R2 = 21K (1 mark)

Ref to µ is divide by 1000000 and 21K in Mega ohms
OR
Manipulation of 21K to Mega ohms (2 marks)

Correct answer = 6.9 (1 mark)
Correct units = Hertz or Hz (1 mark)
(6 marks)

(c) **State what happens to the output when the potential difference across C1 reaches 6V.**

Goes low, goes down

(1 mark)

(d) **Figure 3 shows a method of modelling the circuit.**

(i) **Name the method of modelling used in Figure 3.**

Breadboard, protoboard

(1 mark)

(ii) **Explain one advantage of using this method when modelling circuits as opposed to using computer simulation software.**

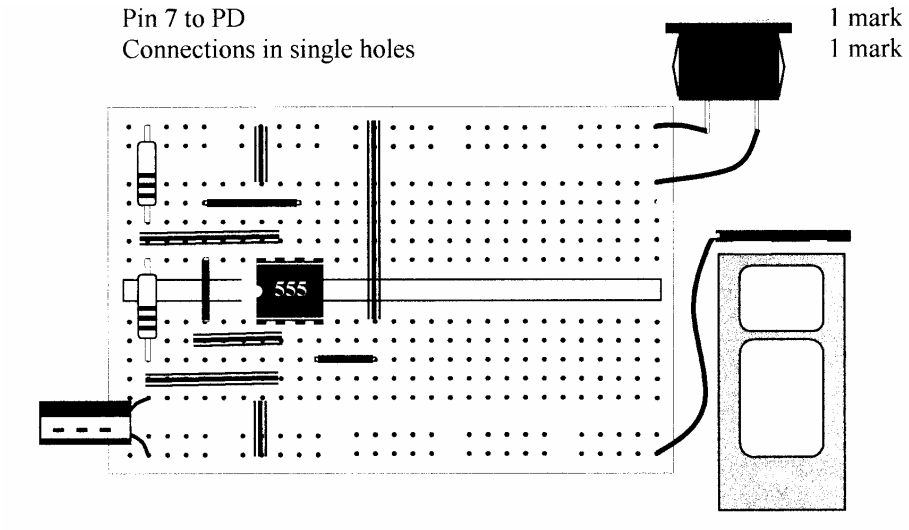
Qualified answer
e.g. cheap set up cost and uses actual component (2 marks)
Simple answer
e.g. cheap (1 mark)
(2 marks)

(iii) **Complete Figure 3 by adding six wire connections to make the circuit work as intended.**

Pin 1 to 0V (1 mark)
Pin 2 to pin 6 (1 mark)
Pin 2 to Cap / Res (1 mark)
Pin 4 to +9V (1 mark)
Pin 8 to +9V (1 mark)
Pin 7 to PD (1 mark)
(6 marks)

Quality of Drawing
Connections in single holes

(1 mark)



2 **It is decided that the fire alarm in Question 1 would benefit from adding a timed testing block.**

(a) **Complete Figure 4 to show where in the system the monostable test would be connected.**

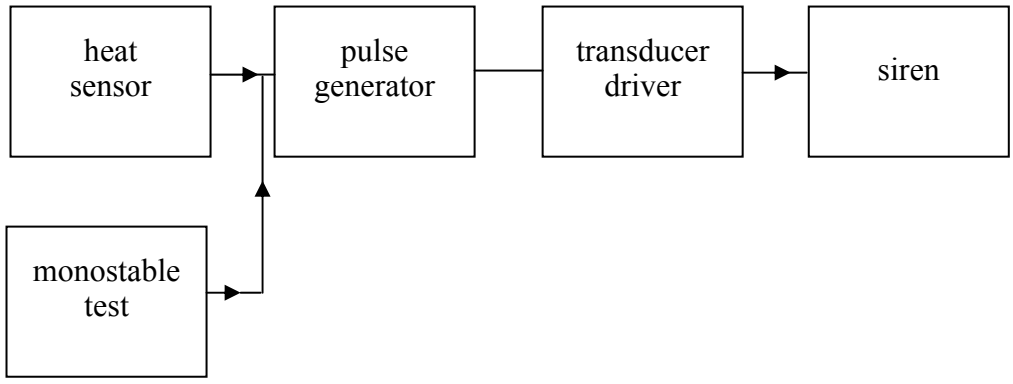


Figure 4

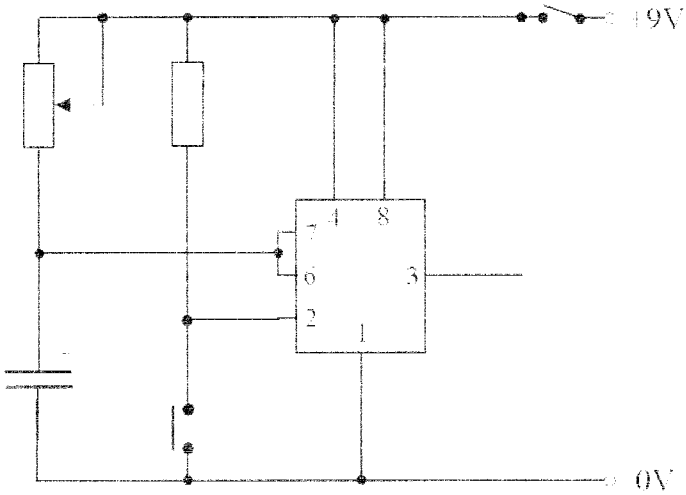
Mono to pulse generator. Also accept connection to pulse generator

(1 mark)

(b) **Figure 5 shows an incomplete circuit used as the monostable test part of the system.**

(i) **Complete Figure 5 by adding:**

- **a 100K resistor and a 470 µF capacitor that will control the time delay;**
- **a pull up resistor and a push to make switch to trigger the time period.**



Resistor correct symbol.	(1 mark)
Capacitor correct symbol.	(1 mark)
Joined correctly to pins 6 and 7.	(1 mark)
Resistor correct symbol.	(1 mark)
Suitable switch correct symbol.	(1 mark)
Joined correctly to pin 2.	(1 mark)
	(6 marks)
Clear, accurate joining of lines.	***(1 mark)***

(ii) **Calculate the time delay of the circuit in Figure 5.**

Correct formula: T = R × C	(1 mark)
working/substitution of numbers	(1 mark)
Answer = 47	(1 mark)
Units: sec or s	(1 mark)
	(4 marks)

3 **You have been asked to design an electronic dice to be used by children when playing games.**

(a) **List two things that you should think about when designing the electronic dice.**

Limited response e.g. number of people, age of people, sight of people. (2 x 1 mark)

A response which supports the statement, e.g. age range of the people expected to use it.
What range of number need to be on view.
Type of power supply. (2 x 2 marks)

(4 marks)

The layout of a research plan for the electronic dice is shown in Figure 6.

(b) **Complete Figure 6 by adding suitable research sources and stating the information that you would hope to find.**

Hands and finger sizes – max/min sizes to make distance in between switches/ability for all ages to use case. (2 marks)

Existing product analysis – to see what people buy now/to find out what people think of current ideas. (2 marks)

Another suitable source – electronics components catalogue. (1 mark)

Information expected from this other suitable source. (2 marks)

(7 marks)

(c) **Describe how the information from the analysis and research may affect the final design.**

Clear statement of intended use of information. (2 marks)
Some intended use of information. (1 mark)

(2 marks)

(d) **Give four specification points for the electronic dice. Two of the points should be about the casing and two about the electronics. Examples have been given.**

(i) **Casing specifications**

Any suitable qualified response. (2 x 2 marks)
Limited responses. (2 x 1 mark).
e.g. Corners of casing rounded off to prevent scratching.
Good surface finish to make the dice look attractive.

(4 marks)

(ii) **Electronic specifications**

Any suitable qualified response. (2 x 2 marks)
Limited responses. (2 x 1 mark)
e.g. To be powered by a 9V battery.
Able to be switched off when not in use.

(4 marks)

4 **This question is about designing, making and evaluating the electronic dice.**

(a)

(i) **Use notes and sketches to show:**

- **a design for the basing of the dice;**
- **how the dice is switched on and activated.**

Drawings and annotation that show details of the case with dice display. (3-4 marks)
Drawings and annotation that show a 'functional' case. (1-2 marks)
(4 marks)

Detail of two switches or clearly identified. (2 marks)
Detail of one switch or poorly drawn two switches. (1 mark)
(2 marks)

Clear sketches and annotation or basic sketch with detailed annotation. (2 marks)
Some sketches and annotation. (1 mark)
(2 marks)

(ii) **Give the name of a suitable material from which the casing could be made.**

Acrylic, HIPS, ABS, MDF or any other suitable specific material.

(1 mark)

(iii) **Use notes and sketches to show:**

- **a suitable method of fitting an LED into the case;**
- **how the circuit is securely held in place in the casing.**

Clear view of LED fixed in LED holder in case or similar. (2 marks)
Some evidence of preparation of material or poor detail (1 mark) (1 mark)
(2 marks)

Clear view of suitable method used to hold circuit in place. (3 marks)
Clear view of a reasonable method used to hold circuit in place (2 marks)
Some fixing of circuit in place (1 mark)
(3 marks)

(b) **List two situations where health and safety hazards might be an issue whilst making the casing and give the precaution that you would need to take.**

Situations related to the construction of the case. (2 x 1 mark)
Appropriate precautions. (2 x 1 mark)
(4 marks)

(c) **Explain two methods of evaluating the finished dice.**

Detailed testing with feedback. (2 x 2 marks)
eg. Test it a 100 times to see if it has a bias
let end users test it and complete a questionnaire

Detailed testing with no feedback. (2 x 1 mark)
(4 marks)

(d) **Give two reasons why quality checks need to be made during the making of electronic products.**

Qualified responses (2 x 2
Non-qualified response marks)
e.g. no mistakes on PCB (2 x 1 mark)
avoid waste
e.g. Reference to prevention of cost of waste materials/components.
Public confidence in companies and future purchases.
(4 marks)

5 **(a)** **Explain one advantage and one disadvantage of installing a PIC microprocessor control system compared to using the present system.**

Advantages
Simple statement (1 mark) (1 mark)
e.g. Less space taken up, or smaller PCB.
Less cost of components.
Qualified statement (2 marks) (2 marks) (2 marks)
e.g. Program can be changed to perform other functions easily if necessary.
(2 marks)

Disadvantages
Simple statement (1 mark)
e.g. High cost
Qualified statement (2 marks)
e.g. High initial cost of buying programmer/software etc.
Need PC to download and to learn programming skills.
(2 marks)

Figure 7 shows a drawing of a lift with its doors open at the ground floor.

The lift will only work when a person has requested the lift from another floor or a floor has been chosen by a person in the lift and the doorway is not obstructed.

(b) **Complete Figure 8 by designing a flow chart to illustrate the lift operating sequence from when the lift starts at the ground floor with its doors open and is called to the first floor where its doors open.**
This is a quality of response question.

Level 3 Response 7 – 10 marks
Clearly presented set of commands which display correct sequencing and appropriate feedback and decisions, whilst also taking into account all the questions within the question.
See examples 1, 2 and 5. Note: to access these marks it is not necessary for them to be in the correct boxes! (7-10 marks)

Level 2 Response 4 – 6 marks
Commands are sequenced correctly with little or no feedback.
Some evidence of decisions evident, whilst also taking into account the restraints in the question.
See example 3.
(4-6 marks)

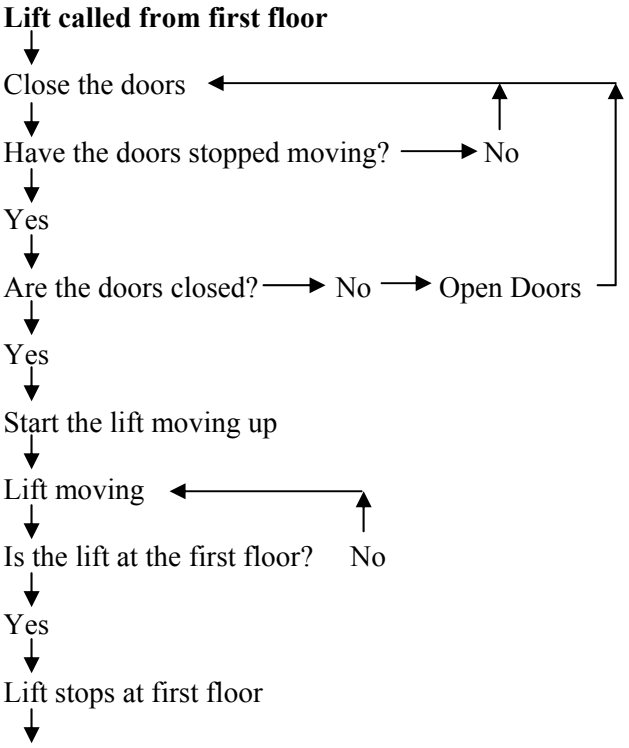
Level 1 Response 1 – 3 marks
Some idea of a command sequence;
only a few aspects of the issues in the question considered.
See example 4.
(1-3 marks)

No recognisable attempt.
(0 marks)

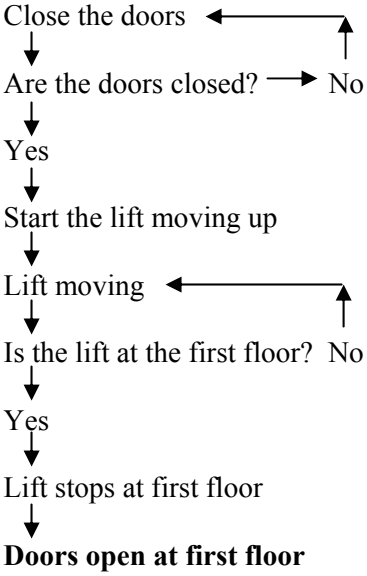
Quality of Drawing ***(10 marks)***
Flowchart is well presented and clearly shows the sequence of events. (2 marks)
Flowchart lacks clarity. (1 mark)
(2 marks)

See the following example pages which show a range of possible solutions.

Example 1 (8, 2)



Example 2 (7, 2)



Example 3 (5, 1)

Lift called from first floor

Doors close

Are the doors closed?

Start the lift moving up

Lift moving

Is the lift at the first floor?

Lift stops at first floor

Doors open at first floor

Example 4 (3, 1)

Lift called from first floor

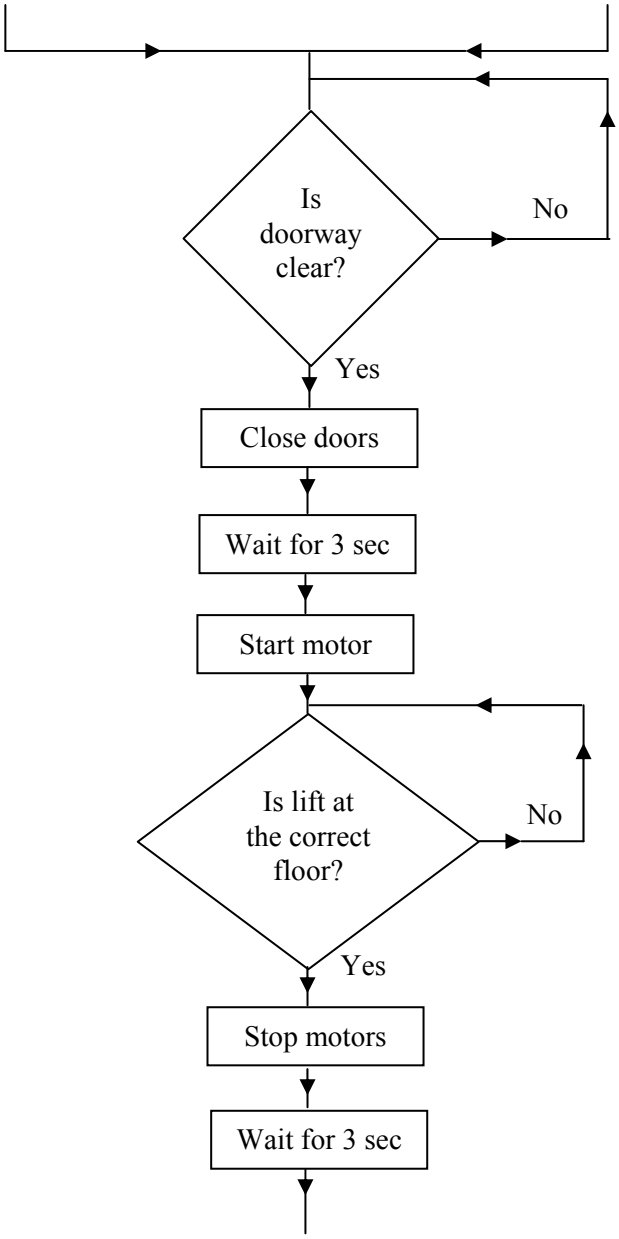
Doors close

Lift moves to first floor

Lift stops at first floor

Doors open at first floor

Example 5 (10, 2)



6 **During the past twenty years the use of ICT and electronic control systems have revolutionised manufacturing.**

Explain one advantage and one disadvantage that these developments have had for the environment.

Advantages

Detailed response. (3 marks)
Statement with some qualification. (2 marks)
Simple statement only. (1 mark)

E.g.

3 marks– Better control of materials during manufacture resulting in less waste and less pollution.
2 marks– Improved systems control the making processes better.
1 mark – Consistent quality products. ***(3 marks)***

Disadvantages

Detailed response. (3 marks) (3 marks)
Statement with some qualification. (2 marks) (2 marks)
Simple statement only. (1 mark) (1 mark)

E.g.

3 marks– Easily obtained, more sophisticated products are always becoming available resulting in a throw away society, which in turn causes an increase in waste and pollution.
2 marks– More products which cause increased waste and pollution.
1 mark – Increased waste and pollution. ***(3 marks)***