Version 1.0

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Design and Technology: Electronic Products 3541

Full Course Foundation Tier

Mark Scheme

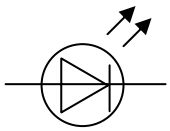
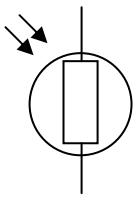
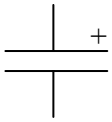
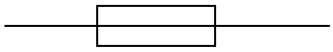
2005 examination - June series

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 on the Insert Sheet shoes eight different electronic components.**

(a) **Complete Figure 2 below by both naming and drawing the electronic symbol for each component. Some parts have been completed as examples.**

Component	Full Name	Symbol
A	LED	
B	Lamp or bulb	
C	LDR	
D		
E	Push to Make	
F	Buzzer	
G		
H	Transistor	

(10 marks)

(b) **Name a component that is described by each of the statements below.**

(i) **It has a resistance that changes as temperature changes.**

Thermistor

(1 mark)

(ii) **It is used to limit the amount of current flow.**

Resistor

(1 mark)

(iii) **It will store a small charge of electricity.**
Capacitor

(1 mark)

(iv) **It will light when current flows from the anode to cathode.**
LED

(1 mark)

(v) **It has a thin piece of wire which melts when overloaded.**
Fuse

(1 mark)

(vi) **It has three leads called anode, cathode and gate.**
Thyristor

(1 mark)

2 **A resistance of 600R is needed in a circuit and as this value is not available, two resistors are to be used in series.**

(a) **Complete Figure 3 by adding the values of the two resistors from the E12 series shown page 3 to give the required 600R value.**
270R (1 mark)
330R (1 mark)
(1 mark)

(b) **Figure 4 shows two 100R resistors in parallel.**

Calculate the resistance of this combination.
Correct formula (1 mark)
Working/substitution of number (1 mark)
Answer (1 mark)
Units R or Ω or ohms (1 mark)
(4 marks)

(c) **Complete Figure 5 to show the colour code of a 680R resistor with a +/-5% tolerance.**
Blue (1 mark)
Grey (1 mark)
Brown (1 mark)
Gold (1 mark)
(4 marks)

3 **Shown below are areas of electronic design where ICT could be used. Choose three areas from the list, stating when each could be used and explaining one advantage for each choice.**

When used – 3 suitable situations (3 x 1 mark)

Advantage – Simple statements (3 x 1 mark)
Qualified statements or multiple simple statements (3 x 2 marks)

e.g.
Circuit simulation– Designing and testing circuits.
Values of components tested before use,
range of development available
I will know exact component values to use.
No components damaged.

e.g.
PCB design – Producing PCB design.
Pad/tracks accurate drawn and spaced,
Track and pad sizes easily changed – etc.

e.g.
Case design – To draw the design for my case.
I will be able to get my drawing the exact size.
Any changes can be made accurately and quickly.
I can view the designs from all angles to see what it looks like.

e.g.
CAM – Making parts of project.
Direct link to CAD, accuracy of fitting.
Creating multiple components etc.

(9 marks)

4 **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. An example has been given.**

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 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

Not too heavy – so that it can be used by young children.
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

The numbers will be made up from arrangements of 5mm LEDs.
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)

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

6 **The automatic doors of a lift in a department store are controlled using logic gates.**

(a) **On Figure 7 draw the missing symbol, name the two logic gates and complete the truth tables.**

AND (1 mark)
0 (1 mark)
1 (1 mark)

NOT (1 mark)
1 (1 mark)
0 (1 mark)

Correct symbol and labelling (2 marks)
Recognisable symbol / incorrect gate but labelled (1 mark)

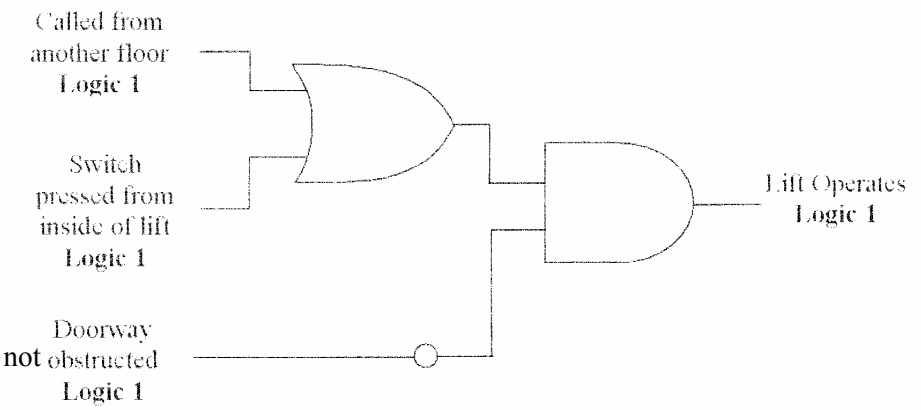
1 (1 mark)
1 (1 mark)
(10 marks)

(b) **The lift will only operate if 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.**

Complete Figure 8 using any of the logic gates shown in Figure 7 so that the lift only operates when the conditions given above, are met.

'Called from another floor to' **OR gate** (1 mark)
'Switch pressed from inside of the lift to' **OR gate** (1 mark)
Correct Symbol **OR** (1 mark)
'Doorway not obstructed' to **AND gate** (1 mark)
OR gate to AND gate (1 mark)
Correct symbol **AND** (1 mark)
NB Possible consequential error from part (a) for the OR gate symbol

(6 marks)



Clear joining of gates / clarity of logic gate symbols. (2 marks)
Joined but lacking clarity. (1 mark)

(2 marks)

7 **Figure 9 shows a block diagram of a fire alarm.**

(a) **State which block represents**

(i) **the final output stage**

Loudspeaker.

(1 mark)

(ii) **an input stage**

Temperature / smoke.

(1 mark)

(iii) **an astable.**

Pulse generator.

(1 mark)

(b) **State the block in which you would find**

(i) **an op-amp**

Comparator.

(1 mark)

(ii) **a thermistor**
Temp sensor.

(1 mark)

(iii) **the control of the frequency of the sound.**
Pulse generator.

(1 mark)

(c) **Figure 10 shows a pulse generator circuit used as part of the system.**

Component C1 helps control the frequency of the circuit.

(i) **Circle the two components other than C1 in Figure 10, that control the frequency of the circuit.**
R1 1 mark)
R2 (1 mark)
(2 marks)

(ii) **Explain the effect on the sound from the loudspeaker if the value of C1 was increased.**
Basic statement
e.g. as frequency changes, sounds different. (1 mark)
Qualified statement
e.g. lower pitch sound, deeper dot, dot, dot.
Lower frequency any other suitable response. (2 marks)
(2 marks)

(d) **The final circuit could be constructed using either veroboard (stripboard) or on a PCB.**

(i) **Compare the use of veroboard as opposed to a PCB for producing the circuit.**
Veroboard has tracks already, spacing set for ICs – PCB needs designing and drawing.
Joins made by wire connection from track to track – all joins built into PCB design.
Track cut with small drill – no breaks needed.
Small set space in between track – track spacing can be varied.
Any comparison. (2 x 1 mark)
(2 marks)

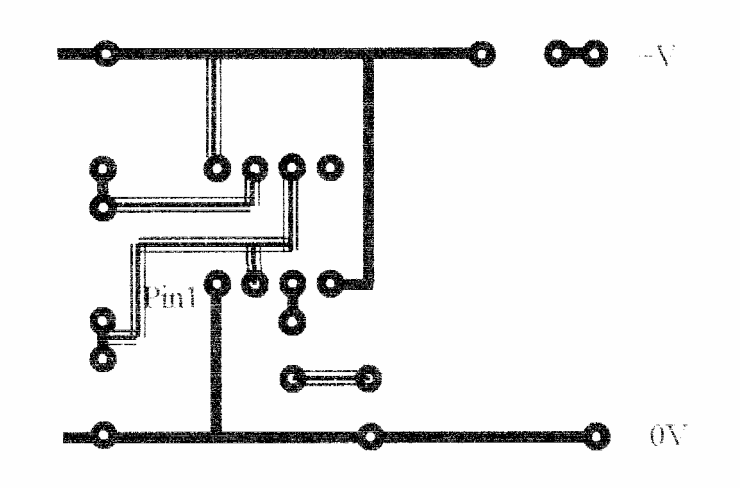
(ii) It is decided that the PCB method will be used.

Figure 11 shows the incomplete PCB design of the pulse generator stage of the circuit.

The pulse generator circuit is shown in Figure 10.

Complete Figure 11 by adding five tracks to the PCB so that:

- **pin 8 is joined to the +V rail;**
- **pin 7 is joined between R1 and R2;**
- **pin 6 is joined to pin 2;**
- **pins 6 and 2 are joined between R2 and C1;**
- **C2 is joined to the loudspeaker.**



Pin 8 joined to the +9V rail..		(1 mark)
Pin 7 joined between R1 and R2.	(1 mark)	(1 mark)
Pin 6 joined to pin 2.	(1 mark)	(1 mark)
Pins 6 and 2 are joined between R2 and C1.	(1 mark)	(1 mark)
C2 joined to the loudspeaker.	(1 mark)	(5 marks) (1 mark)
(Marks to be awarded if any 'links' annotated)		***(5 marks)***

Quality of drawing.

Straight lines (1 mark)	(1 mark)
Accuracy of connection (1 mark)	(1 mark)
	(2 marks)

8 **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)