

**Published Mark Scheme for  
GCE AS Technology and Design**

**Summer 2009**

Issued: October 2009



# NORTHERN IRELAND GENERAL CERTIFICATE OF SECONDARY EDUCATION (GCSE) AND NORTHERN IRELAND GENERAL CERTIFICATE OF EDUCATION (GCE)

## MARK SCHEMES (2009)

### Foreword

#### *Introduction*

Mark Schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

#### *The Purpose of Mark Schemes*

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of 16- and 18-year-old students in schools and colleges. The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.



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New  
Specification



*Rewarding Learning*

**ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2009**

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## **Technology and Design**

**Assessment Unit AS 1**

*assessing*

**Product Design and  
Systems and Control**

**[AV111]**

**WEDNESDAY 27 MAY, MORNING**

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# **MARK SCHEME**

In all cases suitable alternative responses will be given full credit

AVAILABLE  
MARKS

**Section A**

1 (i) Mechanical properties refers to how a material reacts when subjected to forces, e.g. strength, hardness etc. [2]

(ii) Toughness – the measure of how much energy is required to break a material. [1]

Hardness – is a measure of a material's ability to withstand being scratched, cut or indented. [1]

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2 (i) Any **two** main reasons why beech is used for kitchen utensils from the following:

- No taste
- No odour
- Tough and quite hard
- Resistant to water
- Heat resistant
- Insulator
- Durable
- Light weight. [2]

(ii) Any **two** main reasons why ash is used for garden tool handles from the following:  
● Tough and flexible  
● Good resistance to shock  
● Stable material  
● Easily machined. [2]

(iii) Stains change the colour of the wood whilst leaving the grain still visible. They do not provide protection against moisture. Oils provide a water-resistant, non-gloss finish. [2]

6

3 Cases for electric hand tools like drills, jig-saws and sanders can be manufactured by the process of pressure die casting.

(i) Any **two** main reasons why pressure die casting is used from the following:  
● Can be mass produced  
● Fast production method  
● Can produce complex precision parts  
● Products have a high quality finish requiring little finishing. [2]

(ii) Annotated sketch describing the pressure die casting process. This will involve molten metal forced into a cavity between dies under high pressure. After injection the pressure continues for a short time to allow the metal to solidify. The die blocks open and the component is ejected. Sketch [2], annotation [1] [3]

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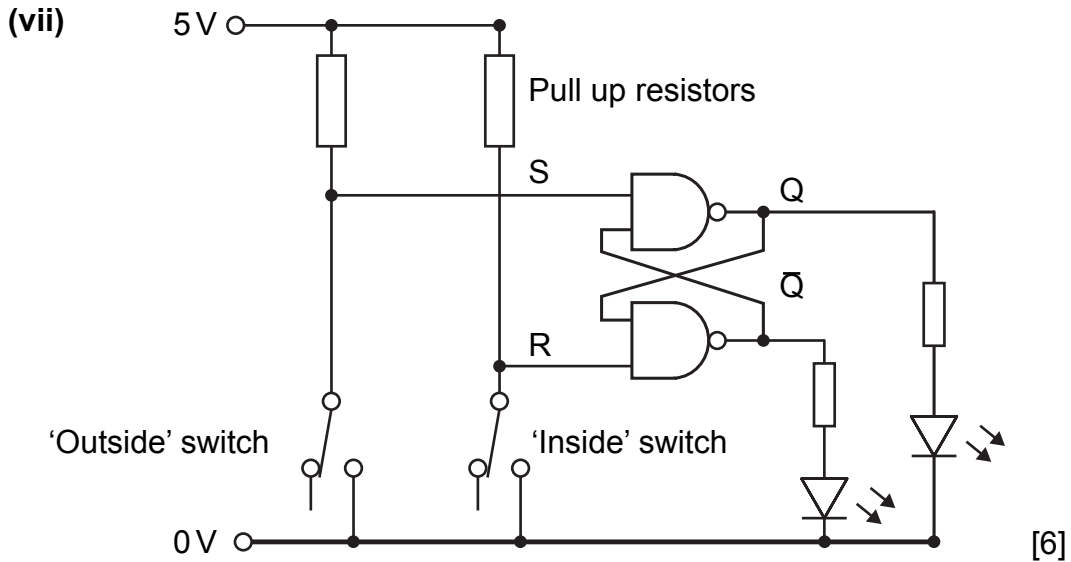
		AVAILABLE MARKS
4	<p>(i) Thermoplastic can be softened and returned to a workable plastic. Thermosetting cannot be re-melted. [1]</p> <p>(ii) Any <b>one</b> main reason why acrylic is used for illuminated signs from the following:  <ul style="list-style-type: none"> <li>● Can be glass-like transparency or be opaque</li> <li>● It can be coloured with pigments. [1]</li> </ul> <p>Any <b>one</b> main reason why nylon is used for gear wheels from the following:  <ul style="list-style-type: none"> <li>● Self lubricating material</li> <li>● Good resistance to wear. [1]</li> </ul> <p>Any <b>one</b> main reason why polyvinyl chloride (PVC) is used for drain pipes and guttering from the following:  <ul style="list-style-type: none"> <li>● Hard wearing material</li> <li>● Suitable for the extrusion process. [1]</li> </ul> <p>Any <b>one</b> main reason why polythene is used for detergent bottles from the following:  <ul style="list-style-type: none"> <li>● Resistant to chemical attack</li> <li>● Strong, and quite a tough plastic</li> <li>● Suitable for blow moulding. [1]</li> </ul> </p></p></p></p>	5
5	<p>Riveting – annotated sketch showing the trapping together of two pieces of metal to be joined using rivets of the same material. [2]</p> <p>Knock down fittings – annotated sketch showing blocks or brackets assembled with screws using screwdriver or allen keys. [2]</p>	4
6	<p>(i) Any <b>two</b> main advantages associated with the use of Computer Aided Design (CAD) from the following:  <ul style="list-style-type: none"> <li>● Can be stored, edited and copied easily</li> <li>● Can be easily viewed in 3D</li> <li>● Contains a wide range of additional features, e.g. layers</li> <li>● Can be used for testing. [2]</li> </ul> <p>(ii) Any <b>two</b> main advantages associated with the use of Computer Aided Manufacture (CAM), (CAD) from the following:  <ul style="list-style-type: none"> <li>● Modifications can be made without expensive retooling costs</li> <li>● Repeat jobs can be quickly downloaded</li> <li>● Can save time and labour and reduce errors. [2]</li> </ul> <p>(iii) Integration of computer with stock control, purchasing order, CAD and CAM throughout the company. [1]</p> </p></p>	5

			AVAILABLE MARKS
7	<p>(i) One-off requires high skill level while mass production uses specialised equipment doing repetitive tasks and as a result requires little or no skill level. [1]</p> <p>(ii) Any <b>one</b> main characteristic associated with one-off from the following:  <ul style="list-style-type: none"> <li>● small numbers of items produced</li> <li>● can be tailored to meet individual client's requirements</li> <li>● high unit cost. [1]</li> </ul> <p>Any <b>one</b> main characteristic associated with batch from the following:  <ul style="list-style-type: none"> <li>● batches of items produced at one time</li> <li>● good flexibility in order to meet individual client requirements</li> <li>● cheaper unit cost compared to one-off. [1]</li> </ul> <p>Any <b>one</b> main characteristic associated with mass from the following:  <ul style="list-style-type: none"> <li>● continuous or very large number of items produced</li> <li>● assembly line production used</li> <li>● only small or little variation to meet client requirements can be achieved</li> <li>● cheaper unit cost compared to the other two methods. [1]</li> </ul> <p><b>mark for clear and coherent explanation using good English grammar.</b> [1]</p> </p></p></p>	5	
8	<p>(i) Proportion – when the relative size and arrangement of parts of a product or design “look right” it is said to be in proportion. [1]</p> <p>Any <b>one</b> main reason why it is an important consideration for the designer from the following:  <ul style="list-style-type: none"> <li>● To ensure that people will like the product</li> <li>● To give the product the opportunity of being successful</li> <li>● To ensure ergonomic appeal. [1]</li> </ul> <p>(ii) Any <b>three</b> different ways that colour may be used in products in order to improve aesthetic appeal from the following:  <ul style="list-style-type: none"> <li>● Contrasting and harmonious colour use</li> <li>● Tonal colours</li> <li>● Colour association</li> <li>● Warm and cold colour use. [3]</li> </ul> <p><b>mark for clear and coherent explanation using good English grammar.</b> [1]</p> </p></p>	6	

**Section B**

**AVAILABLE MARKS**

- 9 (i) State two safety features – including a fuse on the power supply – to prevent fire hazard in the event of a short circuit. A thermal cutout switch to prevent overheating. [4]
- (ii) Thyristor [1]
- (iii) SPDT microswitch [1]
- (iv) Resistors are preferred values (a repeating number sequence). [2]
- mark for clear and coherent explanation using good English grammar.** [1]
- (v) 40 mW [3]
- (vi) Suitable switch arrangement to stop anode current. [2]



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10 (a) (i) 4.5 V [2]

(ii) Briefly explain the function of component Z – comparing voltage  $V_1$  with  $V_2$  and switching the output to +V or -V accordingly. [2]

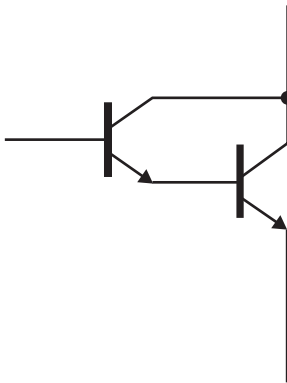
**mark for clear and coherent explanation using good English grammar.** [1]

(iii) 2.8 V in light and 7.4 V in dark. [4]

(iv) off in high light conditions because  $V_2$  will be greater than  $V_1$ . [3]

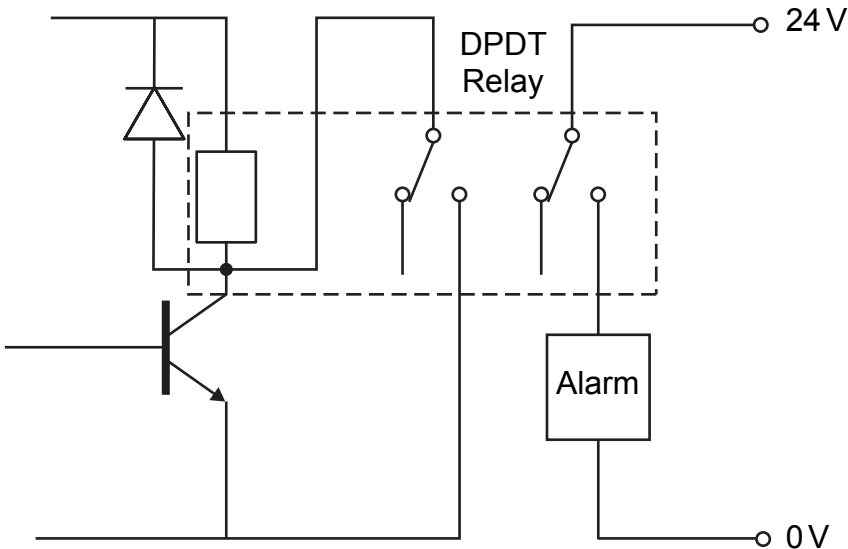
(b) (i) high gain with high collector current capability. [1]

(ii)



[3]

(iii)



[4]

AVAILABLE MARKS

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**Section C**

**AVAILABLE  
MARKS**

- 11 (a) (i)** Toothed [1]
- (ii)** Clockwise [1]
- (iii)**  $A - C = \frac{48}{48} = 1$   
 $D - E = \frac{80}{100} = 0.8$   
 $F - G = \frac{60}{60} = 1$   
 $TVR = 1 \times 0.8 \times 1 = 0.8$  [3]
- (iv)**  $VR = 0.8$   
 $OS = \frac{10}{0.8} = 12.5$   
 $50 \times 3.14 = 157 \text{ circ}$   
 $157 \times 12.5 = 1962.5 \text{ mm/min}$   
 $\frac{1962.5}{60} = 32.7 \text{ mm per sec}$  [3]
- (v)** Annotated sketch outlining and explanation  
 Crank  
 Slider  
 Combination [3]
- mark for clear and coherent explanation using good English grammar.** [1]
- (b) (i)**  $MA = \frac{L}{E}$   
 $1.25 = \frac{200}{?}$   
 $1.25 = \frac{200}{160}$   
 Effort = 160 N [2]
- (ii)**  $VR = \frac{\text{distance moved by effort}}{\text{distance moved by load}}$   
 $1.5 = \frac{1.2}{?}$   
 $1.5 = \frac{1.2}{0.8}$   
 Load moved 0.8 m [3]

$$(iii) \text{ Efficiency} = \frac{MA}{VR} \times 100$$

$$\text{Efficiency} = \frac{1.25}{1.5} = 0.83$$

$$0.83 \times 100 = 83$$

$$\text{Efficiency} = 83\%$$

- 12 (a) (i) Solenoid [1]
- (ii) Pilot/signal air [1]
- (b) Flow control valve [1]  
 Reservoir [1]  
 Correct positioning and piping [1]  
 See answer
- (c) Activation of B [1]  
 Activation of C [1]  
 Activation of D [1]  
 Correct piping and positioning [2]  
 See answer
- (d) NOT gate [1]  
 Positioning of gate [1]  
 Piping Correct function [1]  
 See answer
- (e) DAC [2]  
 Correct piping [2]  
 See answer
- (f)  $F = P \times A$   
 $3.14 \times 40 \times 40 = 5024$   
 $3.14 \times 3 \times 3 = 28.26$  [1]  
 $5024 - 28.26 = 4995.74$  [1]  
 $4995.74 \times 0.4 = 1998.3 \text{ N}$  [1]  
 Explanation [1]
- mark for clear and coherent explanation using good English grammar.** [1]

AVAILABLE MARKS

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Section A

40

Section B or Section C

40

Total

80

Answer number 12(b), (c), (d) and (e)

