

GCE AS

**Technology
and Design**

January 2009

Mark Schemes

Issued: April 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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ADVANCED SUBSIDIARY (AS)

General Certificate of Education

January 2009

Technology and Design

Assessment Unit AS 1

assessing

**Unit 1 – Product Design and Practice:
Materials, Components and their Uses**

[ASV11]

THURSDAY 8 JANUARY, MORNING

**MARK
SCHEME**

Section A

AVAILABLE
MARKS

In all cases, correct alternative responses will be given full credit.

- 1 (a) (i)** Material for the body. Any **two** reasons from the following:
- readily available material
 - suitable due to the properties of durability/water resistant/toughness
 - suitability for surface coatings
- (2 × [1]) [2]
- Material for the plastic insert. Any **two** reasons from the following:
- suitability due to toughness
 - suitability due to the manufacturing process
 - hard wearing material
- (2 × [1]) [2]
- (ii)** Any **two** aspects in support of aesthetic appeal from the following:
- good surface finish
 - good degree of proportion and balance
 - modern hygienic appearance
- (2 × [1]) [2]
- (iii)** Any **two** reasons why the bottle opener is a low cost product from the following:
- relatively low cost materials used
 - standard materials used
 - cost effective processes used and a limited number used
 - minimal assembly required
- (2 × [1]) [2]
- (iv)** Any **two** reasons why riveting was used from the following:
- relatively low cost materials used
 - functional but low cost process
 - semi-permanent method that requires no heat
- (2 × [1]) [2]
- (v)** Manufacturing processes for the handle cast. [1]
Any **one** reason from the following:
- good surface finish
 - only one process for detailed components
 - cost effective in batch production
- [1]
- Manufacturing processes for the nylon insert injection moulding. [1]
Any **one** reason from the following:
- good surface finish
 - only one process for detailed components
 - cost effective in batch production
- [1]
- (vi)** Any **one** reason why chrome plating was used from the following:
- good surface finish
 - modern hygienic looking finish
 - prevents the mild steel rivets from rusting
 - low cost process
- (1 × [2]) [2]

(b) (i) a secure, re-useable plastic cover for the corkscrew tip

Vague sketches lacking detail and appropriate annotation. Difficulties in disseminating if the ideas are appropriate and represent improvements.	0–2
Both the sketches and annotation are limited. The ideas represent improvements but lack the finesse appropriate for the product.	3 or 4
Detailed annotated sketches representing an appropriate improvement to the overall design.	5 or 6

[6]

(ii) semi-permanent method of securing the insert to the body

Vague sketches lacking detail and appropriate annotation. Difficulties in disseminating if the ideas are appropriate and represent improvements.	0–2
Both the sketches and annotation are limited. The ideas represent improvements but lack the finesse appropriate for the product.	3 or 4
Detailed annotated sketches representing an appropriate improvement to the overall design.	5 or 6

[6]

Section A

**AVAILABLE
MARKS**

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Section B

		AVAILABLE MARKS
2	<p>(i) elasticity – the ability of material to deform and return to its original shape and size [1]</p> <p>ductility – property which allows the material to be elongated or stretched [1]</p> <p>malleability – the ability of material to be deformed in all directions without cracking [1]</p>	
	(ii) ductility aids bending, pressing, rolling or forging [2]	5
3	<p>(i) Any one main benefit of using aluminium alloy from the following:</p> <ul style="list-style-type: none"> • to improve its strength • to improve its hardness • non-corrosive properties [1] <p>(ii) e.g. Ladder rungs have raised profiles to ensure grip [1]</p>	
	<p>(iii) Any two specific types of anthropometric data from the following:</p> <ul style="list-style-type: none"> • the average length of a person’s step • the average weight of a person • the average width of a person’s stance <p>(2 × [1]) [2]</p>	4
4	<p>(i) Permanent joining methods are used with the expectation that the components will not be disassembled during their life cycle, semi-permanent joining methods facilitate disassembly during life cycle. [1]</p>	
	<p>(ii) Soldering – Any one from the following:</p> <ul style="list-style-type: none"> • low melting point required around 230 °C • used for joining thin metals • produces relatively weak joint [1] <p>Brazing – Any one from the following:</p> <ul style="list-style-type: none"> • higher melting point required around 600–900 °C • produces a strong joint [1] <p>Welding – Any one from the following:</p> <ul style="list-style-type: none"> • very high melting point required around 3000–3600 °C • produces a very strong joint • used for joining wide thicknesses of metal [1] 	4

			AVAILABLE MARKS
5	<p>(i) suitable material for the extrusion process from the following:</p> <ul style="list-style-type: none"> • PVC • polythene • nylon 	[1]	6
	<p>(ii) Any two main reasons why extrusion is the most suitable process from the following:</p> <ul style="list-style-type: none"> • suitable process for long hollow products • relatively quick one stage process • one stage process produces a high quality finish <p>(2 × [1])</p>	[2]	
	<p>(iii) Suitable sketch of the extrusion process to include the hopper, heated chamber and screw, die and cooling chamber</p> <p>Description</p>	[2] [1]	
6	<p>(i) European Kite marking – It is the mark that shows that a product has met standards set by the EU</p>	[1]	5
	<p>(ii) British Standards – Two benefits from the following:</p> <ul style="list-style-type: none"> • British Standards apply safety standards to products – gives public confidence in product • Kite marked products are easily visible and are recognised standard • These standards are in place to protect the consumer <p>(2 × [1])</p>	[2]	
	<p>(iii) Two benefits to the consumer for Trades Description Act from the following:</p> <ul style="list-style-type: none"> • ensure that the consumer is informed of the country of origin • protects the consumer by making it an offence for a trader to wrongly describe goods or services <p>(2 × [1])</p>	[2]	
7	<p>(i) Any two main reasons from the following:</p> <ul style="list-style-type: none"> • so that the designer knows what precisely what they have to design • establishes clarity between the designer and the client • may prevent confrontation at a latter stage • provides a framework to evaluate the design ideas against <p>(2 × [1])</p>	[2]	5
	<p>(ii) Any two types of information from the user from the following:</p> <ul style="list-style-type: none"> • data on anthropometrics • data on user requirements (optional technologies) • data on preferences/costs for different target audiences <p>(2 × [1])</p>	[2]	

- (iii) Any **one** type of information from the manufacturer from the following:
- manufacturing capabilities/limitations or restrictions
 - availability/cost/properties of specific materials
 - production times and scheduling

[1]

Section B

QWC

Total

**AVAILABLE
MARKS**

5

29

3

60

Quality of written communication

Poor selection and use of a writing form and style appropriate to the content. The script content is poorly organised and little use is made of appropriate Technological vocabulary. The writing is barely legible and the spelling, grammar and punctuation are inaccurate.	0–1
Good selection and use of a writing form and style appropriate to the content. The script content is organised and use is made of appropriate Technological vocabulary. The writing is legible and the spelling, grammar and punctuation are accurate.	2
Very good selection and use of a writing form and style appropriate to the content. The script content is well organised and good use is made of appropriate Technological vocabulary. The writing is clearly legible and the spelling, grammar and punctuation are very accurate.	3



Rewarding Learning

ADVANCED SUBSIDIARY (AS)

General Certificate of Education

January 2009

Technology and Design

Assessment Unit AS 3

assessing

**Unit 3 – Systems and Control:
Industrial and Commercial Practices**

[ASV31]

WEDNESDAY 28 JANUARY, MORNING

**MARK
SCHEME**

In all cases suitable responses will be given full credit.

AVAILABLE
MARKS

- 1 (a) (A) NOT (B) AND (C) EX NOR** [3]
- (b) (i)** Pull up resistor(s) – to ensure the voltage rises to the supply when the switch is not pressed. [2]
- (ii)** NAND gates [1]
Cross coupled [1]
Inputs and outputs labelled [1]
Explanation [1] [4]
- (c) (i)** Variable resistor – to adjust the sensitivity of the circuit or to adjust the point at which the transistor will switch on. [2]
- (ii)** On – LDR resistance is high – voltage across R2 is high therefore transistor is switched on. [2]
- (iii)** 8.6k [3]
- (iv)** $h_{FE} = 55.5$ [3]
- 2 (a) Fig. 2(a)** shows various mechanical components assembled for testing.
- (i)** Name the mechanical component used at **H**.
Ans = Bevel gear. [1]
- (ii)** State the direction of rotation at **E** if **A** rotates in a clockwise rotation.
Ans = Anticlockwise. [1]
- (iii)** Calculate the velocity ratio from **A** to **I**.
Ans = No T Driven/No T Driver
 $A-B = 30/60 = 0.5$
 $C-D = 80/40 = 2$
 $H-I = 60/30 = 2$ [1.5]
 $0.5 \times 2 \times 2 = 2$ [1.5] [3]
- (iv)** Calculate the output speed at **G** if the motor rotates at 480 rev/min.
Ans = No T Driven/No T Driver
 $A-B = 30/60 = 0.5$
 $C-E = 80/40 = 2$
 $F-G = 160/80 = 2$
 $0.5 \times 2 \times 2 = 2$ [3]
OS = IS/VR
 $480/2 = 240$ [1]
- (v)** During testing, the pulley belt between **F** and **G** was found to slip. Using an annotated sketch, name and draw a method/device which could be added to prevent the slippage.
Answer = Jockey wheel. [1]
Suitable annotated sketch of jockey wheel. [2]

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- (b) **Fig. 2(b)** shows part of a raising/lowering mechanism to be added to a camera tripod. On the pro forma provided (Answer number **2(b)**), name and complete the mechanism to allow the lever handle to raise and lower the camera avoiding slippage.

Answer = Rack and pinion. [1]

Suitable annotated sketch of a rack and pinion system. [3]

- (c) A mechanical system has an efficiency of 80% and a mechanical advantage of 4. Showing all calculations determine the velocity ratio of the system.

Ans = $\text{Eff} = \text{MA}/\text{VR} \times 100\%$

$\text{VR} = \text{MA}/\text{Eff} \times 100$

$4/80 \times 100 = 5$

[3]

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- 3 (a) Name the following components as shown on **Fig. 3**:

(i) **X** = Five-port valve. [1]

(ii) **Y** = Uni-directional flow control valve. [1]

- (b) The compressed air supplied to these components has been prepared for use. Briefly describe the main function of **filter** and **lubricator** units.

Ans = Filter – remove dust and water vapour. [1]

Lubricator – add fine mist of oil to ensure the free running of components [1] [2]

- (c) Briefly describe how the double acting cylinder shown on **Fig. 3** instrokes following an outward stroke.

Answer = As the double acting cylinder goes positive air moves out through the tee connector and enters the FCV. Air is restricted at the FCV and slowly builds up the resevoir. Once the resevoir is full, air then proceeds to the 12 pilot activation on the 5PV activating the DAC negative.

Or other suitable answer. [4]

- (d) On the pro forma provided (Answer number **3(d)** and **(e)**) complete the circuit enabling the double acting cylinder to go positive if either **A** or **B** or **C** is activated.

Answer = Method for A [1]

Method for B [1]

Method for C [1]

Shuttle valve and piping [1]

Or other suitable answer [4]

- (e) On the pro forma provided (Answer number **3(d)** and **(e)**) complete the circuit to enable the double acting cylinder to outstroke and instroke slowly.

Answer = FCV employed on outstroke. [1.5]

FCV employed on instroke. [1.5] [3]

- (f) The double acting cylinder with an air supply of 0.5 N/mm^2 is expected to produce a force of 1256.75 N during the instroke.

Calculate the piston area during the outstroke if the piston rod radius is 5 mm .

Please assume $\pi = 3.14$.

Answer = Calc force lost by rod

$$5 \times 5 = 25, 25 \times 3.14 = 78.5, 78.5 \times 0.5 = 39.25$$

Total force produced by piston

$$39.25 + 1256.75 = 1296$$

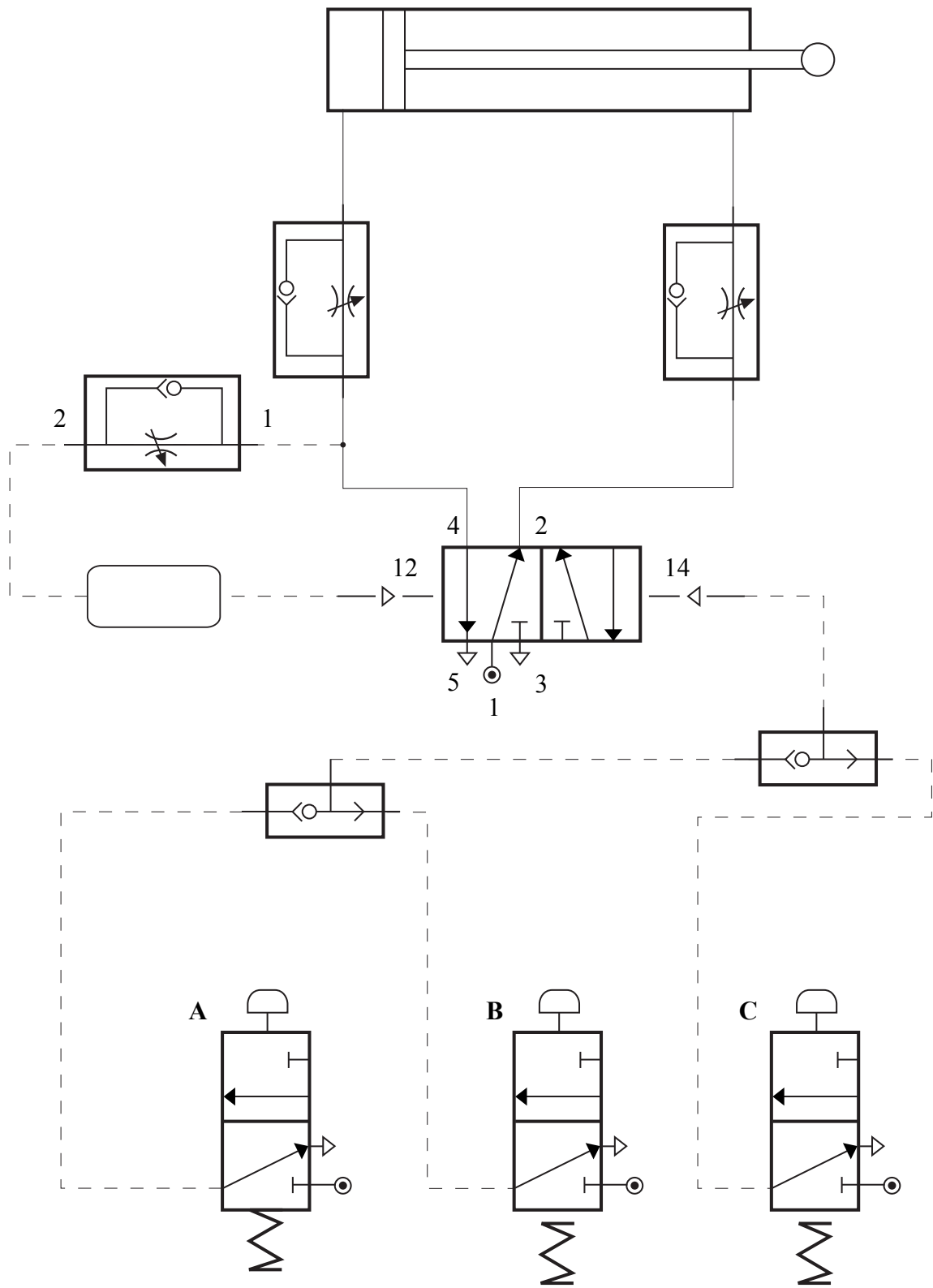
$$1296/0.5 = 2592 \text{ mm}^2$$

[4]

AVAILABLE
MARKS

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3 (d) and (e)



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[3]

Total

**AVAILABLE
MARKS**

3

60