Rewarding Learning

General Certificate of Secondary Education
January 2015

Engineering

Paper 1

Assessment Unit 3

assessing

Engineering Technology

[GEE31]

THURSDAY 8 JANUARY, AFTERNOON

MARK SCHEME

General Marking Instructions

Introduction
Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these general marking instructions.

Assessment Objectives
Below are the assessment objectives for GCSE Engineering.

Candidates must:
- recall, select and communicate their knowledge and understanding of engineering in a range of contexts (AO1);
- apply skills, knowledge and understanding, including quality standards, in a variety of contexts, and plan and carry out investigations and tasks involving a a range of tools, equipment, materials and components (AO2); and
- analyse and evaluate products, make reasoned judgements and present conclusions (AO3).

Quality of candidates' responses
In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking
Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking
Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Type of mark schemes
Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response
Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the "best fit" bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement. The following guidance is provided to assist examiners.

- ***Threshold performance*:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.

- ***Intermediate performance*:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.

- ***High performance*:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Marking calculations
In marking answers involving calculations, examiners should apply the "own figure rule" so that candidates are not penalised more than once for a computational error.

Quality of written communication
Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is limited.
Level 2: Quality of written communication is satisfactory.
Level 3: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level 1 (Limited): Candidate's presentation, spelling, punctuation and grammar is limited. The candidate makes a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary.

Level 2 (Satisfactory): Candidate's presentation, spelling, punctuation and grammar is satisfactory. The candidate makes a satisfactory selection and use of an appropriate form and style of writing supported with appropriate use of diagrams as required. Relevant material is organised with some clarity and coherence. There is some use of specialist vocabulary.

Level 3 (Excellent): Candidate's presentation, spelling, punctuation and grammar is excellent. The candidate successfully selects and uses the most appropriate form and style of writing, supported with precise and accurate use of diagrams where appropriate. Organisation of relevant material is excellent. There is excellent use of appropriate specialist vocabulary.

				AVAILABLE MARKS
1	**(a)**	Socket set Bike brakes (2 × [1])	[2]	
	(b)	Metal gates Metal filing cabinet (2 × [1])	[2]	4
2	**(a)**	Tempered steel/steel Strong material Can withstand high impacts Can be tempered Others considered (2 × [1])	[2]	
	(b)	Metal work vice Material – Body – Cast iron Jaws – steel (Accept either [1])	[2]	
	(c)	Adjustable spanner/wrench Used to tighten and loosen bolts Others considered (2 × [1])	[2]	
	(d)	Dip Coated/painted Reason – to stop corrosion/long lasting/attractive Others considered (2 × [1])	[2]	8
3	**(a)** **(i)**	Physical properties can be observed or measured without changing the composition of the material. Physical properties are used to observe and describe the material. Others considered	[2]	
	(ii)	Texture, colour, appearance, weight. Any **two** examples Others considered (2 × [1])	[2]	
	(b) **(i)**	The mechanical properties of a material describe how it will react to physical forces. Mechanical properties occur as a result of the physical properties inherent to each material, and are determined through a series of standardized mechanical tests.	[2]	
	(ii)	Tensile strength Ductility, toughness, compressive strength, hardness, plasticity, malleability Others considered (2 × [1])	[2]	

				AVAILABLE MARKS
	(c)	**(i)**	Smart materials can change their properties in response to an external stimulus. A modern material is not smart as it does not react to its surroundings but it is a new material that has been created with in the last 50 years. [4]	
		(ii)	Modern Materials examples – Carbon fibre, Kevlar, plastic Others considered (2 × [1]) [2]	
			Smart materials – Polymorph, Silicon Others considered (2 × [1]) [2]	16
4	**(i)**		Spot welding/plastic welding MIG welding Others considered (2 × [1]) [2]	
	(ii)		Pressing Assembly Milling Drilling Cutting Brazing Soldering Others considered (1 × [1]) [1]	
	(iii)		Working to a certain degree of accuracy, e.g. +/- 5% [2]	
	(iv)		Robotic laser measuring systems Robotic X-rays Continuous use using robotic arms to test materials Others considered (2 × [1]) [2]	7
5	**(a)**	**(i)**	Can be viewed in 3D Reduces lead times Can be edited easily Less space needed in the working environment Others considered (2 × [1]) [2]	
		(ii)	CAD drawings can be deleted accidentally Holding up production – Staff will need to be constantly trained in the use of the software The cost of the equipment and software Others considered (2 × [1]) [2]	
	(b)		CNC robotic drill/mill to drill/mill holes and slots CAM is used to make a semi or automatic process [2] Others considered	6

				AVAILABLE MARKS
6	**(a)**	Applying heat to change the working characteristics or shape of a material Others considered	[2]	
	(b)	**(i)** Annealing is when the metal is heated to red hot and then allowed to cool down slowly. Others considered	[2]	
		(ii) Proper face guard and gloves Apron Use appropriate tools and equipment Others considered (1 × [1])	[1]	
	(c)	Normalising Casting Tempering Others considered (2 × [1])	[2]	7
7	**(a)**	Only one person should be using the lathe Make sure the lathe is set to the correct working speed Make sure the area is safe. Remove chuck key Guards in position Others considered (2 × [1])	[2]	
	(b)	Face off Drill hole using a drill bit placed in the tailstock Adjust the tool post and taper the aluminium Part off Turning Any **three** answers (3 × [1])	[3]	
	(c)	Knurling Counterbore Thread Others considered	[1]	
	(d)	Picture A – Tapping – Creating internal screw thread Picture B – Dieing – Creating external screw thread	[1] [1]	8

				AVAILABLE MARKS
8	**(a)**	Continuous operation – Conveyor system to move products along an assembly line, robotic pick and place	[2]	
		Improved reproducibility – CNC drill to accurately remove human error in the drilling of holes, CNC cutting, welding, etc.	[2]	
		Increased speed – Robotic welding of car chassis, spray painting, robotic assembly	[2]	
		Others considered		
	(b)	The internet has enabled increased availability of products worldwide. Products can be made more complex and cheaper increasing market share. Products can be made identical.		
		Others considered		
		(2 × [2])	[4]	10
9	**(a)**	**The size of the workforce**		
		The size of the workforce has been reduced	[1]	
		Others considered		
		Explanation		
		More skilled workforce required due to automation	[2]	
		Others considered		
		Buying in raw materials		
		The internet has improved communication globally for buying in raw materials.	[1]	
		Explanation		
		Materials can be sourced through different websites, etc	[2]	
		Others considered		
	(b)	**Positive effect**		
		Machines are more efficient		
		Products are cheaper		
		Bigger range of products		
		Less breakdown of products	[2]	
		Others considered		
		Negative effect		
		Loss of manufacturing jobs		
		Pollution		
		Short shelf life of products	[2]	10
		Others considered		
10		Use materials that can be recycled and don't damage the environment.		
		Reuse redundant materials waste during manufacture.		
		Use of CAD/CAM can reduce wastage		
		Use more recyclable materials in the products		
		Others considered		
		(2 × [2])	[4]	4
			Total	**80**