Rewarding Learning

General Certificate of Secondary Education
2018

Engineering

Paper 1

Assessment Unit 3

assessing

Engineering Technology

[GEE31]

MONDAY 21 MAY, 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): Candidates 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): Candidates 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): Candidates 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)**	Gears Spanner (2 × [1]) [2]	
	(b)	Filing cabinet Wheel clamp (2 × [1]) [2]	4
2	**(a)**	Lock nut A practical use would be on the handles of a lawn mower. (2 × [1]) [2]	
	(b)	Chuck key A chuck key is used to tighten and loosen drill bits when placed in a pedestal drill chuck/lathe chuck. (2 × [1]) [2]	
	(c)	External calliper An external calliper is a tool that lets the user measure the distance between two opposite sides of an object. (2 × [1]) [2]	
	(d)	Centre punch A centre punch is used to create an indent on metal. (2 × [1]) [2]	
	(e)	Self locking pliers A practical use would be to hold metal parts when welding. They are also invaluable for holding a nut or bolt that has been rounded, or as temporary levers/knobs on equipment and machinery. (2 × [1]) [2]	10

All alternative answers for each part of the question will be considered.

			AVAILABLE MARKS
3	**(a)**	Advantage – Any **one** from the list below: • Reduction of labour; • A less stressful environment; • More milking consistency; • Increased frequency of milking or faster milking Disadvantage – Any **one** from the list below: • High initial set up cost for the farmer; • Reliance on machines; • Increased electricity costs; • Redesign of milking area. All alternative answers will be considered (2 × [1]) [2]	
	(b)	Any **one** from the list below: • Safety monitoring – Sensors are used for monitoring safety conditions when milking the cows, which helps avoid injuries; • Quality control – In the olden days quality control was performed by a manual inspection. Now sensors are employed in the inspection process to determine whether or not the cow needs to be milked; • Data collection of the cow in the robotic work cell – Sensors are used in this category to determine the position of the cow before milking. (Award [2] for a full explanation, award [1] for a limited explanation) All alternative answers will be considered (2 × [1]) [2]	4

			AVAILABLE MARKS
4	**(a)**	• Stage 2 – Mark the position of the four holes and/or four radius corners • Stage 4 – Drill the holes with the appropriate drill bit • Stage 6 – Remove all sharp edges All alternative answers will be considered (3 × [1]) [3]	
	(b)	Any **two** from the list below: • Taper tap; • Tap; • Vice; • Wrench/holder. All alternative answers will be considered (2 × [1]) [2]	
	(c)	Any **two** from the list below: • CNC Punching • CNC Laser cutting • CNC milling • CNC Plasma cutting All alternative answers will be considered (2 × [1]) [2]	
	(d) **(i)**	Any **two** from the list below: • Strength • Ease of working • Cost – Inexpensive All alternative answers will be considered (2 × [1]) [2]	
	(ii)	5 mm diameter hole (1 × [1]) [1]	10

		AVAILABLE MARKS
5 **(a)**	Any **two** from the list below: • Ensure that the mill bit is rotating at the correct cutting speed; • Use the appropriate mill bit for the task; • Lubricate the work. All alternative answers will be considered (2 × [1]) [2]	
(b) **(i)**	The explanation must relate to the use of modern technologies and make reference to the monitoring procedure. Example – In CIE the system can be programmed to check products by removing them at random intervals for checking. [1] Robotic arms can remove products from conveyor systems, manipulate them through checks/scanners. [1] The product will either be accepted or rejected and any adjustments will be made automatically. [1] Reference to modern technology [1], detailed explanation [2] Reference to modern technology [1], limited explanation [1] All alternative answers will be considered (1 × [3]) [3]	
(ii)	Any **one** from the list below: • Digital vernier calliper; • Vernier calliper; • Digital micrometer; • Go/no go gauges All alternative answers will be considered (1 × [1]) [1]	
(iii)	The description must include at least two points. • Slide the jaws of the vernier in tight against the object being measured. [1] • Read the main scale where it lines up with the sliding scales zero, or read the digital readout if using a digital vernier. [1] All alternative answers will be considered (1 × [2]) [2]	8

			AVAILABLE MARKS
6	**(a)**	Plating or spraying All alternative answers will be considered (1 × [1]) [1]	
	(b)	**Plating** Degreasing to remove impurities or Manual cleaning to remove all residual traces of dirt and surface impurities or Various pretreatments depending on the process [1] Placement into the chrome plating vat, where it is allowed to warm to solution temperature [1] Application of plating current for the required time to attain the desired thickness [1] **Spraying** Wire brush and sand the rim to remove all rust and caked on deposits [1] Mask off the tyre using masking tape or appropriate alternative [1] Prime the rim using spray primer and top coat the rim several times using spray paint [1] All alternative answers will be considered (1 × [3]) [3]	
	(c)	Any **one** from the list below: • Ensure that the company has a good ventilation/extraction system in place; • Workers should wear a mask; All alternative answers will be considered (1 × [1]) [1]	
	(d)	Any **two** from the list below: • Increased wear resistance • Increased corrosion resistance • Increased aesthetics All alternative answers will be considered (2 × [1]) [2]	7

		AVAILABLE MARKS
7	Any **two** from the list below:	
(a)	Hardwood – Sometimes called broad-leaf trees. [1] They lose their leaves seasonally, in winter. [1] Hardwoods tend to be harder than softwoods (with the exception of Balsa Wood). [1] They have a wider variety of colour and texture than softwoods. [1] Hard woods tend to be more expensive than softwoods and take longer to mature. [1] Example – Mahogany, [1] Oak [1] All alternative answers will be considered	
(b)	Any **two** from the list below: Softwood – Softwoods are from trees that have needles / exposed seeds, not leaves. [1] They grow quickly, compared to most hardwoods. [1] When sawn and planed they tend to be light/pale in colour. [1] Softwoods also tend to be cheaper than hardwoods. [1] Example – Scots pine, [1] Red Cedar [1] All alternative answers will be considered	
(c)	Any **two** from the list below: Manufactured board – They are more stable than natural woods and are less likely to warp and twist out of shape. [1] They are all manmade in factories/mills. [1] They are usually composed of natural woods and resin, which binds them together. [1] Example – Plywood, [1] MDF [1] All alternative answers will be considered (3 × [2]) (3 × [1]) [9]	9
8	**(a)** Pneumatics – Uses pressurised air Hydraulics – Uses pressurised fluids. All alternative answers will be considered (2 × [1]) [2]	
	(b) Advantage – There is very small chance of a fire compared to hydraulic oil and therefore less of a fire hazard. All alternative answers will be considered (1 × [1]) [1]	
	(c)	

	Name	**Function**
A	Double Acting Cylinder	Double Acting Cylinders use the force or air to move the piston in both directions. They can be used to move objects on a production line.
B	Reservoir	The reservoir is used for storing compressed air to operate pneumatic equipment.
C	Shuttle Valve	A shuttle valve is a type of valve which allows air to flow through it from one of two sources.
D	Lever operated Five port valve	A lever operated five port valve is the equivalent to an electronic switch. It allows air to flow from Ports 1 to 4, or Ports 1 to 2. It has two positions.

Names – To achieve full marks the names have to exact (4 × [1])
Function – All alternative answers will be considered (4 ×[1]) [8] 11

			AVAILABLE MARKS
9	**(a)**	Any **two** from the list below: • Rollers; • Motor; • Continuous belt; All alternative answers will be considered (2 × [1]) [2]	
	(b) **(i)**	Hydraulic All alternative answers will be considered (1 × [1]) [1]	
	(ii)	Hydraulics can exert larger forces [1] compared to pneumatics [1] All alternative answers will be considered (2 × [1]) [2]	
	(c)	Any **four** from the list below: • Steel toe capped boots; • Safety helmet; • High visibility jacket; • Heavy duty gloves; • Safety goggles; All alternative answers will be considered (4 × [1]) [4]	9

10 Indicative content:

- Replace old machinery with the more modern equivalent;
- Generate their own energy source, wind/solar;
- Better maintenance of machinery to give optimum efficiency;
- Turn off lighting when not in use;
- Reduce, reuse, recycle, to minimise transport fuel costs;
- Access off peak energy from their electricity supplier;
- Better accurate control of material usage to minimise machining/processing.

All alternative answers will be considered [8]

Response Type	Description	Mark Band
	When a response is worthy of no credit [0] marks should be awarded	**[0]**
Limited	Students correctly identify one way a company can reduce their costs and or energy consumption. The level of accuracy of spelling, punctuation and grammar is limited in most cases. The form and style is generally inappropriate as is the use of specialist terms.	**[1]–[2]**
Satisfactory	Students correctly identify two ways a company can reduce their costs and or energy consumption. The level of accuracy of spelling, punctuation, and grammar is satisfactory in most situations. The form and style is satisfactory in most cases and specialist terms are used appropriately in some cases.	**[3]–[5]**
Very good	Students correctly identify three/four ways a company can reduce their costs and or energy consumption. The level of accuracy of spelling, punctuation, grammar is very good. The form and style is of a high standard and specialist terms are used appropriately at all times.	**[6]–[8]**

Total **80**

AVAILABLE MARKS