

Examiners' Report/
Principal Examiner Feedback

Summer 2012

GCSE

Application of Technology in Engineering
and Manufacturing

Unit 5EM03 Paper 3A

Printing and Publishing, Paper and Board

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Unit 5EM03_3A

Printing and Publishing, Paper and Board

General Comments

Overall, the two sections within this paper produced a varied range of responses.

Lower ability candidates often gave generic responses to questions, such as 'Quick', 'Fast' or 'Cheap' etc which gained limited marks. The more demanding questions, especially towards the end of Section A and Section B, were difficult for some candidates and consequently a significant proportion gave inappropriate responses. Some candidates misunderstood the technical terminology in the questions and/or based their answers on an incorrect context and therefore generated low quality responses.

It was extremely pleasing, however, to see that the majority of candidates attempted all questions and empty spaces were kept to a minimum throughout the paper.

Some candidates would benefit from being taught examination skills and techniques, as often they did not read the questions properly, and 'describe', 'explain' or 'discuss' questions were answered using single word statements and/or bullet points, as opposed to the 'It's...because...which means...' method.

Section A

Question 1

The majority of candidates correctly identified the products belonging to the Printing and Publishing sector in part (a) and Paper and Board sector in part (b); however, a very significant minority chose the response 'Plasterboard fixing' for part (b), which was incorrect (the correct response being 'Lever arch file').

Question 2

For (a), the majority of candidates correctly named the two items used in the manufacture of paper or board products, namely the 'Stapler' and 'Sticky tape' (most candidates named the second item as 'Sellotape', which was marked as correct). The most popular incorrect answers were 'Duct tape' or 'Masking tape'.

For (b), the majority of candidates provided responses focused on 'cutting in straight lines' and 'cutting accurately' for the Guillotine, but few mentioned its capability to cut in multiples. Furthermore, many candidates could not explain the use of the Flexi-curve, with many responses centred on 'measuring curves', thereby missing the repeatability/consistency aspect of drawing complex curves.

Question 3

A generally well answered question; however, a small but significant proportion of candidates confused Control terms with ICT terms. The terms 'Programmable logic controllers (PLCs)' and 'Pick and place robots' were often identified as belonging to the ICT Key area; similarly, the term 'Databases' was often

identified as belonging to the Control key area, all of which are incorrect. Pleasingly, the vast majority of candidates correctly identified 'Foil lined board', 'Bleed proof card' and 'Acrylic' as belonging to the Modern materials key area.

Question 4

The majority of candidates gained marks for (a)(i); popular answers included products used in the pre-release materials for examination papers from previous years, such as 'Food packaging'. Other popular responses included 'Greeting cards', 'Tickets', 'Calendars' and 'Leaflets' (all awarded marks as polymers are normally present in printing inks/finishes). When candidates did not gain the second mark for this question it was normally because the product was not from the Printing and Publishing, Paper and Board sector, or it was a material rather than a product. Part (a)(ii) was not well answered, with 'Corrugated cardboard' (not a polymer) the most popular response, and in direct contrast to (a)(i), several candidates named a product here rather than a material. The majority of candidates that gained a mark for this question gave 'Polythene' as their answer. When correct answers were given for (a)(i) and (a)(ii), the responses for (a)(iii) often gained full marks, for example [when 'Cereal packaging' given as a correct answer in (a)(i) and 'LDPE' given as a correct answer in (a)(ii)] 'It's flexible, as you can fold and bend the inner packaging so it can go inside the outer packaging' and 'It doesn't have a really low melting point so it can be stored in environments that are hotter than room temperature, e.g. cupboards'. When an incorrect material was given in (a)(ii) (such as 'Corrugated cardboard') most candidates were still able to access 2 marks for (a)(iii), with generic responses associated with the aesthetic/environmental/mechanical characteristics of materials, such as 'It can be recycled easily' or 'It is durable'. Candidates that did not score on part (a)(iii) normally gave no response in (a)(ii), or stated a product/process in (a)(ii) and then gave the advantages of the said product/process in (a)(iii) (please refer to the 'follow through rules' in the mark scheme).

Part (b)(i) was generally well answered, with 'Production/processing' and 'Materials supply and control' the most popular answers for 1 mark. Popular responses that were not creditable included the stages of 'Design' and 'Marketing' or processes such as 'Die cutting' or 'Printing'. When 'Design' or a production process was given as the response for (b)(i), candidates may not have scored on part (b)(ii), with answers often associated with the advantages of CAD or the benefits of a particular process. A broad range of answers in the mark scheme however, meant that generally good marks were awarded for (b)(ii), especially when a correct response was seen for (b)(i), for example ['Production' given as a correct answer in (b)(i)] 'Systems and Control technology can be used to ensure that all the parts are made to the correct quality as the production is monitored, which reduces the amount of faulty parts that are made'. The environmental advantages of systems and control technology were often highlighted in good candidate responses, particularly when considering the impact on waste reduction/early detection of defects, or the safety aspects, especially when considering the use of guards/sensors etc.

Question 5

Part (a) was generally answered well, with many candidates gaining higher (4 to 6) marks. Where candidates gained lower marks their answers were often

repetitive or associated with CAM, systems and control technology or the production stage. Low quality CAD responses were often very generic and just stated obvious benefits rather than how it contributes to new product development, eg 'Drawings are highly presentable' or 'People don't need to train for as long as they used to'. Most popular and correct responses focused around converting from 2D to 3D, the ease with which modifications can be made and amended drawings being sent to suppliers, clients and colleagues quickly. Examples of specific, 2 mark responses included 'Standard parts such as nuts and bolts can be imported into the drawing and don't have to be redrawn each time, saving labour costs', 'Drawings can be sent to a colleague easily which means he can edit it and update the system so everyone has access to the most up to date version', 'It allows people to see what it would look like in real life as you can convert from the drawing to a virtual model and move it around in different directions' and 'You can test the drawn part by using the simulation feature without actual making it'.

Part (b) was also answered well with the award of 2 marks prevalent; most appropriate answers were associated with accuracy, reduced wastage, consistency and speed, with better candidate responses noting that a manufacturer may use CAM as it has efficiency benefits over longer production runs once set up. Further sound responses centred around costs/safety, for example 'A manufacturer could reduce costs as a smaller workforce would be needed, but it also means that the remaining workforce would be safer as the CAM machines can deal with the more dangerous jobs, and they don't tire'; in contrast, poor responses were highly generic, eg 'It's quicker' or 'It's easier'. A small proportion of candidates read the question as CAD and answered accordingly, which was incorrect.

Question 6

The majority of candidates gained both marks for part (a)(i), with a response such as 'Email means you can communicate and send messages using the internet and you can attach documents to them that the customer can respond to'. Correct answers associated with saving and referring to earlier messages at a later date were seen less frequently. A large range of mainly correct responses (for 2 marks) were seen for (a)(ii); most focused around the necessity to have internet access and the possibility that messages may not be received/accessed immediately/corrupted. High quality candidate responses often noted the issues associated with viruses carried by attachments.

For part (b)(i) most candidates gained 1 mark by stating 'Face to face meetings' or 'Telephone calls'. The most popular incorrect answer was 'Travelling', which is perhaps understandable, but could not be accepted as a traditional method of communication that has been replaced by video conferencing. Pleasingly, very little repetition was seen in part (b)(ii), and most candidates gained marks with 'More economical', 'More environmentally sustainable', 'More convenient', 'Saves time', 'Easier to organise' type responses. For example 'It cuts down on the hassle and cost of travelling especially if the customer is a long way away', 'It can be a quick way to meet if the companies need to make a deal or confirm information with each other when a telephone call isn't suitable' or 'Meetings can be undertaken simultaneously, as staff won't have to travel to different locations and this enhances decision making which saves time'. Correct answers associated with recording the video conference and being able to playback at a

later date were seen less frequently.

Question 7

Centres are reminded that the paper is ramped in difficulty and the latter questions in each section are aimed at the more able candidates; as a result, this question required an ability to provide specific responses, by drawing upon specialist knowledge.

Surprisingly, part (a) elicited a strong response from most candidates, with many gaining 1 or 2 marks; popular answers focused around a benefit of, 1) easy access to data; 2) accurate, up to date information; 3) being able to monitor costs; and 4) ordering materials in a timely fashion, for example 'It means supplies and materials can be ordered just in time to meet the production schedule as it is easier to forecast what will be needed and when', 'The system will have accurate information which means it can be set to order stock automatically so the production department can keep making the parts' and 'It can help to control waste due to monitoring of the process and there is fast access to data using queries'. Incorrect answers were often generic and lacking a production link, such as 'They are easy to look at when you are designing something'.

There was a very mixed response to part (b), and most candidates gained 0 to 2 marks as answers were frequently repetitive; furthermore, generic responses with no packaging and dispatch link were seen often, such as 'They reduce the amount of money needed and the chances that the customer will be unhappy with the product' or 'They help the environment as they conserve energy'. Conversely, other candidates often gave 'loading onto trucks' or 'putting products into boxes' type responses, as they concentrated on the 'packaging and dispatch' aspect of the question, when what was actually required were two benefits information and data handling systems have on packaging and dispatch. Simple, but popular correct answers included 'Accurate addresses will be stored which will stop orders going to the wrong place' or 'They could highlight that several orders going to the customer should be shipped together, saving money'. More able candidates provided specific answers for 4 marks (2x2), including 'Scanning software/barcodes can be used to record and log dispatch information, so there is less chance of human error and less need to stocktake' or 'Detailed dispatch history details can be kept meaning the next time they need to send to the same client they can check their earlier orders and copy the delivery and invoicing details'. Correct answers associated with ensuring that driver delivery schedules are efficient/stock security/efficient use of storage space were seen less frequently.

Section B - Based upon the 'mass produced temporary point of sale display' pre-release material

Question 8

A well answered question for all three parts. Candidates were able to effectively explain, using notes and sketches, the function of the Stand, Compartments and Hoarding. The vast majority of candidates had clearly undertaken extensive research based upon the pre-release material, and those that provided incorrect

responses often described a manufacturing process for the part in question, rather than the function (e.g. a printing technique). Centres should note that full marks can only be attained with a written response and sketches for each of (a), (b) and (c); a significant number of candidates omitted one or the other, or just labelled a sketch without describing the function of the part.

For (a), the majority of candidates gained 3 marks, with a sound 3D sketch and written answers associated with areas for advertising (eg 'The stand has white areas for promotion'), positioning of the items to be sold (eg 'It holds the products at an angle so they don't fall out, are easy to see and keeps the products off the floor') and support/stability (eg 'The stand stops the display falling over if somebody knocks it as it has a wide base so the products don't fall').

For (b), the majority of candidates gained 2/3 marks, with a sound 3D sketch and written answers associated with holding the sale items (eg 'The compartments make sure the products don't fall out of the display'), allowing more products to be displayed (eg 'Different products can be held at the same time'), visibility of sale items (eg 'Makes it easy to see the different products as they are in different compartments') and allowing possible customers to pick up the items easily (eg 'The compartments mean that customers can pick up the products and look at them without others falling out').

For (c), the majority of candidates again gained 2/3 marks, with a sound 3D sketch and answers associated with promotion of the items for sale (eg 'The hoarding is used to advertise the products and show branding'), giving sales information (eg 'The hoarding can give information about cheap prices and bogofs') and visibility of information (eg 'It is at the top so it can get attention for the products and can be seen from a distance'). Correct answers associated with easy removal/changeover of the hoarding, so promotions can be amended, were seen less frequently.

Question 9

For part (a)(i), the vast majority of candidates were able to correctly add the missing stages in the list (Production planning and Production/Processing) for 2 marks. For (a)(ii), most candidates correctly named the stage as 'Design' ('...where images are *created*...'); where candidates provided an incorrect response to this question, the stage was normally named as 'Production' (where images are *printed*).

Part (b) was generally well answered, with many candidates gaining three plus marks overall. Responses for (b)(i) were of a higher standard than those for (b)(ii), with the majority of candidates gaining at least 2 marks for answers associated with market research (such as 'Gathering opinions/questionnaires'), advertising the product, identifying gaps in the market/trends (marketing planning) and deciding on a product cost, for example 'A marketing plan is created to ensure the product is suitable for the target market, using market research to obtain information from customers. At this stage the product would then be advertised through media and electronically' (3 marks). Incorrect responses often focused on the Design stage or how to advertise the pre-release product, rather than what actually happens at the Marketing stage. There was a somewhat mixed response to the Materials supply and control aspect of the

question; most popular (and correct) responses were associated with monitoring/controlling/ordering stock, and answers such as 'Factors including cost and environmental impact of the materials would be considered and then controllers would make decisions about purchase quantities and what point in the production process the order should go into suppliers. Once stocked the materials would be quality control checked and replenished when needed' gained full marks.

Poor responses were seen very regularly, where candidates often described activities associated with the Production planning stage, for example 'Making sure that the materials machinery can produce in sufficient quantities and make the right amount in the right order' or at the Packaging and dispatch stage, with incorrect 'Organising transport' type answers occurring frequently. Less valid responses also suggested that QC is only required at the Materials supply and control stage. It was rare that fully developed answers, and hence a score of 6 marks, were seen for both parts of (b), as most of the descriptive responses tended to digress.

Question 10

Part (a) was well answered, with 'Corrugated board' the most popular correct answer and 'Corraflute' seen less frequently (for 1 mark). The most popular incorrect answer was 'Cardboard' (or 'Card').

Part (b)(i) elicited a mixed response, which was surprising; answers that gained the full 3 marks were not as frequent as expected, with many candidates stating other printing processes, such as 'Gravure'/'Letter press'/'Flexography', or other manufacturing stages/manufacturing terms, such as 'Packaging and dispatch', 'Systems and control', 'Health and safety,' or sometimes even 'Materials'. 'Die cutting', 'Embossing', 'Laminating', 'Scoring', 'Folding', 'Varnishing' and 'Gluing' were the most popular correct responses, with 'Shearing' seen very rarely.

For (b)(ii), some candidates that had studied the pre-release material were able to offer complete responses in relation to why web-fed offset lithography is a suitable process for printing onto the surface of temporary point of sale displays, for example 'It can print on a wide range of display boards, has good reproduction quality and is very economical if the print run is somewhere between 250000 and 500000' (for 3 marks); however, in general (b)(ii) was not answered very well, with a number of candidates gaining only one mark with simplistic responses such as 'It's cheap and fast'. It is surprising that many candidates were unable to gain higher marks on this question, by providing responses with some specificity to web-fed offset lithography, as the pre-release material referred to 'high volume printing processes', of which there are few. The vast majority of candidates continue to focus on speed/cost when asked questions associated with particular printing techniques and fail to note more specific benefits, such as the durability of printing plates, the levels of automation possible when using web-feed etc.

Conversely, some good responses were often seen for (c), with the award of 2/3 marks prevalent. Popular answers were associated with enhanced aesthetics ('Modern materials can help the stand to look good as you can use different printed colours and textures'), mechanical characteristics ('The practicality of the stand can be improved by using reinforced boards that are strong and can put up with being knocked about') and functionality ('Materials can be used which are

lightweight so the stand can be moved to different places in the shop'). More able candidates tended to state a range of specific material developments and how they could apply to the temporary point of sale display, such as 'Laminates would be used so the stand wouldn't be ruined if something was spilt on it', 'Phosphorescent pigments can be used to make the stand glow in the dark when the shop is shut' and 'Modern materials can make the display catch the eye of customers by using holographic images' etc. Sound responses associated with the environmental benefits of modern materials were also evident but not seen as often as expected. Where candidates gained lower marks their responses were sometimes focused on the production process or their answers were simplistic and unqualified, eg 'They cost less'.

Question 11

Part (a)(i) proved to be a very challenging question, and as a result the vast majority of candidates gained low marks. Responses noting standard quality control examples associated with printing were often seen, such as 'Use a densitometer/colour bars/crop marks' but this type of answer was incorrect as such techniques are not used at the packaging and dispatch stage when manufacturing temporary point of sale displays. Generic responses associated with what happens at the packaging and dispatch stage were often evident, such as 'The point of sale displays are flat packed and then put into larger boxes', but again these responses were not creditable as no link was made to quality control. Popular and correct low level responses included 'Check to see that the packaging is sealed correctly by looking at it' or 'Inspect how the boxes are stacked so that damage doesn't occur'. Better responses for 4 marks (2x2) were often more specific to the requirements of the question, such as 'Bar codes will be used so the boxes for the displays can be tracked as they go out and when they are delivered' and 'Packaging will be assembled and measured quickly with a tape so that they can make sure the displays fit into the box and will not be cramped in which will damage them'.

Part (a)(ii) also proved to be challenging for the majority of candidates, and the majority only gained 0 to 2 marks. Responses often described a particular packaging and dispatch process, such as 'Moving the display into a box then storage', but such answers gained little credit as no linked automation example was provided, e.g. '...using pick and place robots'. Generic benefits of automation were also seen, such as 'The automatic machines don't tire and can work 24/7' but such answers again gained minimal marks as the question did not require a list of advantages. Popular and correct low level responses included 'The packaging may be put onto a conveyor belt to be loaded into the lorry' or 'An automatic stamper will label the packages so customers know where they are from'. Better responses for 4 marks (2x2) included 'Cardboard display packages will be made waterproof as an automatic wrapping machine will rotate it around so it is covered in thin clear plastic' or 'To make sure flat pack boxes move along at the right time to erect them then tape them up PLCs are used'.

Part (c) proved to be a more straightforward question with the majority of candidates gaining some credit for responses such as 'It's less likely the product will come out wrong' or 'Less products that are faulty will end up in the shops' (for 1 mark) and 'Less waste will be produced as displays that are work in progress will be monitored for quality and if something is going wrong it can be put right before more are made' (for 2 marks).

Question 12

Part (a)(i) was well answered, and the majority of candidates gained 2/3 marks for this question. Popular responses were generally associated with, 1) less staff being needed and the impact on employment; and 2) the requirement for more training to update skills and knowledge associated with the new technology. Better responses (for 3 marks) were more specific to the question context and included answers such as 'The working environment will become cleaner and safer for employees because modern presses are normally automated and enclosed, which means humans don't have to be hands on but do have to be better qualified to programme, monitor and control the machines. Staff might also have to do shift work as the presses will probably run all night'.

For 12(a)(ii), some less able candidates essentially continued their response to 12(a)(i), by focusing on the working environment rather than the global environment, for example 'It will probably be noisier' (0 marks). Popular (and correct) responses to 12(a)(ii) normally focused around answers such as 'Modern technology is more accurate meaning far less waste' (for 1 mark) or 'More materials (or energy) will be used by the new faster technology which means deforestation (or a higher use of fossil fuels/more pollution) to keep up with production requirements' (for 2 marks). The more able candidates normally considered both the positive and negative environmental impacts of changing to modern technology, such as 'If the modern machinery makes displays that are better quality there will be less waste produced and carbon emissions could be reduced as the new technology will be more efficient, but if the factory starts to make more and more displays, pollution could increase overall as more electricity and plastic would be needed and natural resources would be consumed at a quicker rate' (for 3 marks).

Part 12(b)(i) normally generated answers that gained 2 marks or 0 marks; suitable, correct and popular responses included 'The use of spreadsheets to record customer feedback and other information', 'Word processing to create questionnaires', 'Email to advertise the product' or 'Videoconferencing to communicate with focus groups'. Generic or simplistic responses to this question, with no marketing link, gained no credit, for example 'Websites will be used' or 'Research'.

For 12(b)(ii) no marks were available for generic ICT responses such as 'Documents can be modified by different people', as creditable answers required a design link; however, the majority of candidates still gained marks for responses associated with using CAD, simulation/virtual models, designing in 2D/3D, investigating existing designs and sending drawings to the client/colleagues via email so designs can be edited.

Part 12(b)(iii) had a similar profile to 12(b)(ii), as a number of responses were generic and lacked specificity to the distributor, for example 'ICT means they can store lots of information' or 'The distributor would not have to keep repeating things as he could use copy and paste' (0 marks). Good responses (for 3 marks) considered the distributor's role and the types of ICT that may be used, such as 'All products dispatched can be recorded in a database through the use of a bar code scanner which will mean that the distributor knows his stock levels and which orders are complete', 'It allows all customer contact details to be collected so letters can be mail merged which means multiple communications can be sent to them via email' or 'They could use sat navs so that they can plan to make the

most of their delivery lorries which means less fuel and more profit'.

Question 13

Candidate responses to this question generally gained 0 to 2 marks. Popular answers focused around responses such as 'Safety will be improved and control technology will reduce the risk of accidents', although such responses didn't explain the reasons why, which limited the marks gained. Some candidates provided generic responses associated with control technology, such as 'You get less waste', without a link to the impact on safety, therefore gaining no marks; nevertheless, some excellent responses to this question were seen (for 4 marks), such as 'Machinery in manufacture has guards and sensors which means they can shut down straight away if something goes wrong, and this reduces the risk of accidents. Also control technology can mean that machines can work automatically in dangerous environments, which reduces the risks to humans further. If control technology means they can be run automatically there are less humans on the production line so humans are less likely to get hurt through losing concentration and getting tired, as they will probably be in the control room rather than near the machine'. Surprisingly, very few candidates mentioned a fundamental aspect of modern, safe manufacturing environments; the use of control technologies to monitor parameters and trigger alarms.

Question 14

The latter questions in each section are written to challenge the most able candidates, and consequently the standard of response to this question was mixed; the majority gained some credit for their response (0 to 2 marks), but a significant proportion of candidates did not attempt the question. This was somewhat surprising, as candidates' exposure to questions that have an environmental bias, across a variety of subjects, has increased in recent years. Nevertheless, some excellent responses were seen, with several able candidates attempting to consider each manufacturing stage when discussing how energy consumption can be reduced, and others giving answers that were highly specific to the point of sale display with good coverage of a variety of energy-related manufacturing themes. For example, 'The manufacturers could use CAD when designing so they don't have to use a lot of energy making mock ups as they can simulate them on screen. When they are making the point of sale displays they could use quality control so that they don't make mistakes and produce them right first time so they don't have to use more energy replacing the bad ones. They could also use space more efficiently by employing a JIT system so they don't have to heat and light storage space. If they plan journeys more efficiently and make the point of sale displays flat pack they could get lots more on the lorries and save on petrol for deliveries, and they could also get local firms to supply them with recycled materials saving on petrol again and meaning less energy is used converting trees into pulp then corrugated card for the point of sale displays'.

Popular, but less detailed responses were primarily focused around making the machines more energy efficient and switching off equipment/lighting when not in use. A number of incorrect answers were seen where candidates provided purely environmental responses that did not relate to reducing energy consumption, such as 'Machines can be bought that don't pollute and so there will be less smoke going into the atmosphere and less acid rain', and several suggested that traditional methods would be less energy intensive when manufacturing high volumes of the point of scale display, which is unlikely/unrealistic considering the

extra production time required. Centres should note that the 'quality of written response' is also taken into account for this question, and therefore accurate spelling, punctuation and grammar were required for the highest marks (please see the mark scheme for further details).

Grade Boundaries

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