

Examiners' Report/
Principal Examiner Feedback

Summer 2013

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 students 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 students and consequently a significant proportion gave inappropriate responses. Some students misunderstood the technical terminology in the questions and/or based their answers on an incorrect context and therefore generated low quality responses.

Some students 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. In addition, students should be encouraged to attempt all questions on the paper.

Section A

Question 1

The majority of students correctly identified the products belonging to the printing and publishing sector in part (a) and the paper and board sector in part (b); however, a significant minority chose the response 'E-book reader' for part (b), which was incorrect (the correct responses being 'Toilet roll' and 'Recycled envelopes').

Question 2

For (a), the majority of students correctly named the two items used during the manufacture of printing and publishing, paper and board products, namely the 'Safety knife' and the 'Circle template' (most students named the first item as 'Craft knife' and the second item as 'Circle stencil', both of which were marked as correct). Where students only gained 1 mark this was normally because they didn't recognise the second item.

For (b), both parts were generally answered well; in the main, lower scoring responses didn't fully explain the use of a T-square, with 'To draw lines at 90°' often seen for 1 mark but no extension for the 2nd mark, such as 'and to provide a horizontal reference'. Furthermore, very few students referenced its use in supporting a set square.

Question 3

A generally well answered question; however, a significant proportion of students confused Control terms with ICT terms. The terms 'Automated conveyors' and 'Embedded computers' were often identified as belonging to the ICT Key area; similarly, the term '3D prototyping' was often identified as belonging to the Control key area, all of which are incorrect. Pleasingly, the vast majority of students correctly identified 'Hydrochromic ink', 'Duplex board' and 'Polyvinyl acetate (PVA)' as belonging to the Modern materials key area.

Question 4

Appropriate responses to (a) included products used in the pre-release materials for examination papers from previous years, such as 'Cereal packaging', 'Paperback books' and 'Point of sale displays'. Other popular responses included 'Newspapers', 'Greeting cards', 'Booklets for computer games', 'Calendars' and 'Pizza boxes', and the vast majority of students gained 2 marks for this question. When students 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 a material was given rather than a product.

Part (b)(i) was also generally well answered, with 'Design' the most popular response; however, 'Marketing' and 'Production' were also seen frequently. Popular responses that were not creditable included processes, such as 'Die cutting' and 'Printing' or types of technology, such as 'CAM'. Students that did not score on part (b)(ii) normally gave no response in (b)(i), or stated a process or technology (rather than a stage) in (b)(i) and then gave an inappropriate explanation of the said process/technology in (b)(ii). However, when a correct answer was given for (b)(i), the responses for (b)(ii) often gained full marks, for example [when 'Design' was given as a correct answer in (b)(i)] 'CAD drawings can be easily amended so if improvements are necessary it doesn't take long to make all the changes' and 'CAD can link easily to rapid prototyping or on screen virtual models can be manipulated, so expensive full size models don't have to be made'.

Part (c)(i) was also well answered, with a variety of types of board/card stated by the majority of students; however, 'Laminates' and smart materials, such as 'Phosphorescent pigments' were also popular and correct answers. Again, when a correct response was given in (c)(i) invariably the student gained both marks for (c)(ii), with an answer that focused on the aesthetic/environmental/mechanical characteristics of the material, such as [when 'Cereal packaging' given as a correct answer for (a) and 'Cardboard' given as a correct answer for (c)(i)] 'It is easy to print on so it means the product can be more visually appealing and it is stiff/tough enough to protect the food inside, whilst also being easy to recycle which makes the product seem sustainable'. Students that gained no marks for this question often gave a description of the material itself and didn't link the said description to how the characteristics of the product are changed, such as 'Thermochromic ink changes colour as the amount of heat in its environment changes' or 'Holographic materials can display several different images on the same piece of card or board'.

Question 5

Part (a)(i) was not answered particularly well. A clear CAM link was required for the mark to be awarded, and very generic answers were often seen, such as 'When making' or 'For one off production', which were not creditable. More able students gave appropriate responses such as 'CAM controls and links the machines that make a product' or 'Translating a digital design to an output such as a CNC plotter'. A wide range of answers in the mark scheme meant that the majority of students gained two marks for question (a)(ii); if brief, generic responses, such as 'It's quicker and more accurate' were seen together, only 1 mark was awarded; however, many responses were explained well, such as 'It's good for producing lots of products quickly as once it's set up it can be left and all you need to do is check the products that come off it' (for 2 marks).

Most students gained the mark for (b)(i), and in the main, it was also answered well. Popular, correct responses included answers such as 'To produce a virtual 3D model', 'To simulate the way a design works' and 'To develop ideas'. Incorrect responses were normally associated with CAM again [the focus of questions (a)(i) and (a)(ii)]. Part (b)(ii) was also answered well, demonstrating students familiarity with CAD, and many responses gained both marks. An example of a type of answer that was very popular, for 2 marks, was 'CAD drawings can be easily amended rather than redone and onscreen virtual models can be manipulated and tested, meaning that expensive 3D models are not required and you can do modifications much easier'.

For (c), the majority of responses gained 2 marks with an answer focused on product consistency and faster production. More able students considered the benefit of CAM use in terms of the variety that it can afford the consumer, such as 'The same product can be modified more easily on the machine and this means the consumer can have a product that suits their taste' (for 2 marks). Where students gained lower marks for (c) this was mainly because a simple statement, such as 'Cheaper for consumers', was not explained.

Question 6

Most students gained 2 marks for part (a); popular answers were associated with storing/organising data and displaying charts/graphs, with numerous references to columns and rows. Several students gave the benefits/advantages of spreadsheets rather than describing the term, but answers such as 'It's good at carrying out calculations as you can add formulas to work out profit' were creditable.

Part (b)(i) was answered very well, and responses stating 'paper documents' or 'paper files' were both popular and correct. Incorrect answers for (b)(i) often included communication-based responses such as 'Letters' or 'Posting documents', or they suggested that databases had replaced manual labour. For (b)(ii), a good range of responses were seen, and it was generally well answered. Most students gained 2 to 3 marks overall for responses associated with convenience, cost/time/space savings, access to up to date information etc, for example 'They cut down on the use of paper records and it means information can be easily transferred between them and kept up to date so products that are urgent can be made quickly' (for 2 marks) and 'It means that information is easier to see and can be searched using queries which will lead to better stock control and less supply problems' (for another 2 marks). Where students gained lower marks for (b)(ii) they often gave responses such as 'Quicker'/'Faster'/'Easier'/'Simple' which were not creditable without further explanation. Many responses for (b)(iii) focused on security issues, both in terms of storage and unauthorised use, such as 'Without backing up a database the information could be lost, and important financial data could be hacked which could threaten the manufacturer's business' (for 2 marks), and the question was generally answered well. Other popular responses considered the possibility of incorrect data being entered, such as 'Humans could enter wrong information and the manufacturer might make bad decisions by looking at facts that are wrong'. Incorrect responses for (b)(iii) often focused on the specific disadvantages of spreadsheets rather than databases.

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 students; as a result, this question required an ability to provide specific responses, by drawing upon specialist knowledge. The majority of answers for (a) gained 1 mark, and students seemed to have a very

limited understanding of the specific benefits of PLCs in relation to safety in manufacture. Most responses were quite generic; popular, low scoring answers included 'They reduce danger/hazards' or 'They mean humans don't have to get near the making'. High scoring responses explained the particular safety-related benefits of PLCs, such as 'PLCs quickly sense if there is a problem with a process and will shut things down so that people don't get hurt or will stop the process from starting in the first place. PLCs are very reliable too, so you don't need to keep checking that they are working properly, which could be dangerous in itself' (for 3 marks).

Part (b) was not answered particularly well either, with most students gaining 1 to 2 marks, again demonstrating a limited understanding of the specific benefits of PLCs, this time in relation to production efficiency. Again, lower scoring responses included generic answers, such as 'There will be less faulty products' or 'They are very reliable and will keep working'. Responses that gained higher marks were often associated with their capability to deal with multiple inputs/outputs, such as 'They improve efficiency as they can be reprogrammed easily which means they can carry out a variety of different tasks all at once. This all saves cost and reduces downtime as the manufacturer will not need to spend lots of time rewiring equipment' (for 3 marks). Responses that made reference to the small size of PLCs, when compared to switches/relays etc, were seen very infrequently.

Section B - Based upon the 'mass produced school diary planner' pre-release material

Question 8

A well answered question for all three parts. Students were able to effectively explain, using notes and sketches, the function of the spiral binding, rigid covers and elastically bookmark. The vast majority of students had clearly undertaken extensive research based upon the pre-release material, and those that provided incorrect responses sometimes described a manufacturing process for the part in question, rather than the function.

Centres should note that full marks can only be achieved with a written response and sketches for each of (a), (b) and (c); a significant number of students omitted one or the other, or just labelled a sketch without describing the function of the part (see below).

For (a), the majority of students gained 3 marks, with a sound 3D sketch and written answers such as 'It binds the pages together', 'It means the planner can lie flat', 'It allows the planner to open 360 degrees' and 'It means pages are less likely to fall out'. Where students gained lower marks for (a) it was mainly because a suitable sketch wasn't provided or a function was given that was incorrect, such as 'It makes it easy to add pages'.

For (b), the majority of students gained 3 marks, with a sound 3D sketch and written answers such as 'They stop the paper from absorbing liquid', 'They prevent the planner from bending' and 'They protect the pages inside'. Where students gained lower marks it was mainly because a suitable sketch wasn't provided or the sketch was simply labelled and functions weren't stated.

For (c), the majority of students again gained 3 marks, with a sound 3D sketch and answers such as 'To keep the pages in place anywhere in the planner', 'So you can go straight to that week's page', 'It will stop other pieces of paper falling out of it' and 'It

stops your planner from opening and getting ruined in your bag'. Where students gained lower marks it was mainly because a suitable sketch wasn't provided or the properties of the elastic were stated rather than the function of the bookmark.

Question 9

For part (a)(i), the vast majority of students were able to correctly add the missing main stages in the list ('Production planning' and 'Material supply and control') for 2 marks. Non-creditable responses often stated 'Product planning' rather than 'Production planning' or 'Materials' rather than 'Material supply and control', or sometimes the correct responses were entered in the wrong order.

For (a)(ii), almost all students correctly named the stage as 'Packaging and dispatch'.

Part (b) was generally well answered, with many students gaining four plus marks overall. Responses for (b)(i) were of a higher standard than those for (b)(ii), with the majority of students gaining 2 to 3 marks. It was pleasing to note that answers were often contextualised, focusing specifically on what would happen at the design stage for school diary planners. Responses associated with the use of CAD for designing and modelling and generating prototypes were popular, as well as answers based around agreeing design criteria and getting the necessary information from the school (client) to be printed in the planner. Poorer responses often gave descriptions of CAD and/or were related to the production rather than the design stage. There was a somewhat mixed response to the Marketing aspect of the question [(ii)], with most students gaining 2 marks; most popular (and correct) responses were associated with finding gaps in the market, advertising (using the internet/traditional methods) and getting the opinion of schools/conducting surveys (market research) in order to improve initial ideas, but very few students considered the wider aspects of marketing, such as developing a marketing plan/competitive edge. Weaker answers often suggested that this would be the stage where decisions about materials and production processes would be made. 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)(i) was not particularly well answered, with generic responses such as 'Paper' or 'Plastic' seen frequently, both of which were not creditable as they lacked specificity. Popular correct responses included 'Polypropylene', 'Bleed proof card' and 'Solid white board'. For (a)(ii) the majority of students gained marks by explaining a range of properties that make steel suitable when used for the spiral binding on the school diary planner, such as 'It is durable so it might bend slightly if dropped but it won't totally break and can be bent back into shape', 'It can resist rusting when something spills on it as it can be treated and painted which will also make it look better' and 'It is ductile meaning it can be shaped into the spiral easily and the wire can be thin which will cost less'. Where students gained lower marks this was normally as a result of using inappropriate terminology, such as 'It is mouldable' or 'It is renewable'.

Part (b)(i) elicited a mixed response, which was surprising; answers that gained the full 3 marks were not as frequent as expected. 'Lithography', 'Cutting', 'Assembly' and 'Finishing' were the most popular correct answers, and incorrect responses included 'Quality control', which was seen frequently, 'CAD', 'CAM' or stages of manufacturing

(such as 'Design', 'Marketing' etc) rather than production processes. Pleasingly, repetitive responses where three different types of printing process were given (such as 'Letter press'/'Flexography'/'Gravure') were seen less often than in previous series.

For (b)(ii), some students that had studied the pre-release material were able to offer complete responses in relation to why punching is a suitable process for making the rigid plastic cover of the school diary planner, but the majority of students only gained between 1 and 2 marks. Popular and correct responses for (b)(ii) focused on the ability of the punching process to penetrate different materials, of varying thicknesses, leaving a precise finish that needs no further work, such as 'Punching can go through the paper and the plastic cover, so they can all be punched together and this will mean the diary is accurate so the wire can go straight into the holes'. Responses related to the reliability of the process and the low amounts of waste produced were also correct and seen frequently. Answers that attracted lower/no marks were often associated with the diary itself rather than the punching process, such as 'It's so the pages don't fall out', 'So it will last a long time' or 'To make the diary stronger'. Very few students gave responses associated with the process being simple to automate, which again was surprising.

Question 11

A variety of responses were seen for (a)(i), with most students gaining a mark for an answer that suggested process control was associated with 'checking'. Students that gained 2 marks were normally able to extend the aforementioned response by referencing subsequent 'changes', such as 'This is a system that checks processes to make they are working to specification and if not it can change them so they are' or 'This is where the machinery is monitored to check that it is performing the tasks to the right standard and if not it will fix the faults'. Very few students gave responses associated with data collection/comparison, use of PLCs/embedded computers or closed loop feedback. Weaker responses were normally quite generic, such as 'To speed things up' or had an inappropriate link to CAM, such as 'It's used to link up computer controlled machines'. A wide range of creditable answers in the mark scheme meant that the majority of students gained 2 to 3 marks overall for (a)(ii); examples of popular answers that gained 2 marks included 'If a mistake is being made it will be spotted at that stage and rectified immediately to stop the mistake spreading to all other products', 'To ensure that all the machines are operating the way that they should, which reduces waste and improves worker safety' or 'Because it makes sure all processes are operating efficiently, which means more will be made and this improves profit' (a combination of which generated all 4 marks). Generally, students that gained lower marks repeated answers in the space for the second reason or they provided responses that were not explained, such as 'To save time' or 'To make the product reliable'.

Part (b) proved to be a challenging question, with a lot of repetition in responses meaning that most students gained between 1 and 3 marks overall. However, it was pleasing to see that many students referred to specific examples of QC used in the sector, for example 'Using colour bars to check the tone and density of printed colours is right' or 'Using registration marks to make sure printing plates are in line and CMYK print correctly'. Popular answers were also associated with functional checks (eg 'Checking the planner opens/closes correctly') or size checks (eg 'Measuring the first few made with a ruler'). Poorer responses were often related to checking the amount being made or were associated with quality control techniques used at a manufacturing stage other than production. Some

less able students were able to state the types of checks but not how they should be carried out, or they may have given the benefits of the check, which was not required by the question.

Question 12

Part (a)(i) was not answered well by the majority of students, as many gave responses associated with the size rather than the type of workforce required, and/or advantages of automation were stated (due to the link with replacing workers), such as 'They work for 24/7 without having breaks or getting tired'; such responses were possibly attributable to students not having read the question properly. Answers that attracted higher marks were normally associated with the capabilities of the workforce, such as 'Workers will be more skilled as they will have to fix the machinery rather than use it'.

For (a)(ii), the majority of students were awarded 1 to 2 marks as a lot of repetition was evident, and again, it seemed some students did not read the question properly. Correct and popular responses often focused on the environment being safer, such as 'The machines now do most of the dangerous work so less accidents happen and people don't get hurt as much', unfortunately, a very similar safety related response was often given again in the space for Change 2. Furthermore, responses associated with the size of the workforce were again seen frequently [see the comments above for (a)(i)], and answers such as this were not creditable. More able students gave responses that were directly related to the production environment, such as 'Modern processes can all be enclosed which means there is less noise and it's cleaner for the workers', with a second different response of a similar quality also evident, for all 4 marks.

Part (a)(iii) was answered well by the majority of students, with most focusing on material developments (meaning products last longer or are more sustainable) or reductions in the amount of waste produced/fossil fuels used, such as 'Meetings can be held using Skype which means people don't have to travel and less oil is used'. Weaker answers were often associated with the production environment rather than the global environment, such as 'There are now a lot less hazards at work so staff don't get hurt', or a disadvantage rather than a benefit was stated, such as 'Modern technology means globalisation and products aren't made locally'.

Generally, students only gained 1 to 2 marks for (b), and those that gained higher marks produced answers that were very specific to the packaging and dispatch stage; furthermore, they often referenced stock records, tracking and automation in their response, such as 'The bar code can be automatically scanned as part of a data handling system when the box of printed planners are being sent to the school, this is so they can be tracked and the manufacturer knows when they have arrived. It also means the stock list can be automatically updated so that the manufacturer knows how many planners are still in stock' (for 4 marks). Some good responses associated with traceability were also seen. Where students gained lower/no marks the responses often described what a bar code is/how to use it, without any link to the advantages for a manufacturer or the packaging and dispatch stage.

Question 13

The majority of students gained between 2 and 3 marks for this question, with answers associated with improved durability, aesthetics and sustainability all popular. Students that gained full marks for this question gave a very specific responses that explained why the customer would be satisfied, such as 'The board used for the

covers is now more durable, so it's less likely to rip from the spiral binding and the pupil will not lose pages and get in trouble. Also the materials can have a water resistant finish so they don't absorb moisture and get damp in your bag. The paper might also be made from potato starch so it will biodegrade which is important for school pupils as that makes the planner sustainable'. Weaker responses often just stated a range of modern materials or described a material without linking the said description to its impact on customer satisfaction.

Question 14

Although the standard of response was mixed overall, the majority of students attempted this final question, which was pleasing, and most gained some credit for their answer. Some excellent responses were seen, with several students providing answers that were very specific to the question in hand, such as 'Modern technology makes the production stages of making the planner more efficient so there will be less waste. This means that production costs will be easily covered and the manufacturer can sell the planner more cheaply, therefore attracting more schools and making more money. As the product is priced lower more schools will be willing to buy it and it will be easier for marketing to sell it and for them to fit the needs of the target market. Also, as modern technology in production ensures high accuracy and precision, and products are consistently made to high standards, it will be easier to market and sell the planner as schools will know it is worth the money and won't fail. Modern technology will make the production rate quicker too, and marketing will be able to say that they can provide their planners more quickly and that they won't have to wait, which will also help selling and improve profits'. Generally, lower scoring responses suggested reasons why marketing should be used to justify investment in modern production processes, or they discussed the effects of marketing/selling for a manufacturer with no link to how improvements in modern technology/production processes can affect the strategy employed. 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 refer to the mark scheme for further details).

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

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