



Pearson

Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCE
In Design & Technology (6GR02)
Paper 01

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Summer 2017

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark									
1(a)	<p>Award one mark for each material property, up to 2 marks One mark for each example of use for each paper type</p> <table border="1" data-bbox="256 398 1233 1700"> <thead> <tr> <th data-bbox="256 398 405 510">Paper Type</th> <th data-bbox="405 398 863 510">Material properties</th> <th data-bbox="863 398 1233 510">Example of Use</th> </tr> </thead> <tbody> <tr> <td data-bbox="256 510 405 1144">Tracing Paper</td> <td data-bbox="405 510 863 1144"> <ol style="list-style-type: none"> 1. Translucent/transparent (1) 2. Thin (1) 3. Pale grey colour (1) 4. Low strength (1) 5. Smooth (1) 6. 60-90gsm/<i>lightweight</i>. (1) 7. Accepts ink/pencil well (1) </td> <td data-bbox="863 510 1233 1144"> <ol style="list-style-type: none"> 1. Making copies of drawings (1) 2. Outline sketches of page layouts (1) 3. Working / architectural drawings (1) 4. Initial ideas sketching (1) 5. Overlaying designs (1) 6. Transferring images (1) <p>DO NOT ACCEPT 'TRACING' AS A SINGLE WORD ANSWER.</p> </td> </tr> <tr> <td data-bbox="256 1144 405 1700">Copier Paper</td> <td data-bbox="405 1144 863 1700"> <ol style="list-style-type: none"> 1. Opaque (1) 2. Usually 80gsm (1) 3. Pure/bright white colour (1) 4. Medium strength (1) 5. Textured surface (1) 6. Smoother (than cartridge paper) (1) 7. Heavier than an appropriate comparison - e.g. layout paper (1) 8. good quality print possible / accepts most media (1) </td> <td data-bbox="863 1144 1233 1700"> <ol style="list-style-type: none"> 1. Laser/inkjet printing (1) 2. Initial design work / sketching(1) 3. Plotting CAD designs (1) 4. Photocopying (1) 5. Leaflets/flyers (1) </td> </tr> </tbody> </table> <p style="text-align: center;">Do not accept "drawing" as not specific enough</p> <p style="text-align: right;">6 x 1</p>	Paper Type	Material properties	Example of Use	Tracing Paper	<ol style="list-style-type: none"> 1. Translucent/transparent (1) 2. Thin (1) 3. Pale grey colour (1) 4. Low strength (1) 5. Smooth (1) 6. 60-90gsm/<i>lightweight</i>. (1) 7. Accepts ink/pencil well (1) 	<ol style="list-style-type: none"> 1. Making copies of drawings (1) 2. Outline sketches of page layouts (1) 3. Working / architectural drawings (1) 4. Initial ideas sketching (1) 5. Overlaying designs (1) 6. Transferring images (1) <p>DO NOT ACCEPT 'TRACING' AS A SINGLE WORD ANSWER.</p>	Copier Paper	<ol style="list-style-type: none"> 1. Opaque (1) 2. Usually 80gsm (1) 3. Pure/bright white colour (1) 4. Medium strength (1) 5. Textured surface (1) 6. Smoother (than cartridge paper) (1) 7. Heavier than an appropriate comparison - e.g. layout paper (1) 8. good quality print possible / accepts most media (1) 	<ol style="list-style-type: none"> 1. Laser/inkjet printing (1) 2. Initial design work / sketching(1) 3. Plotting CAD designs (1) 4. Photocopying (1) 5. Leaflets/flyers (1) 	(6)
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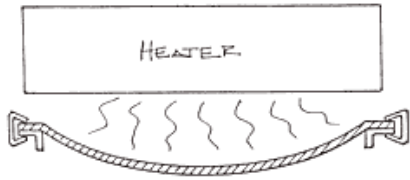
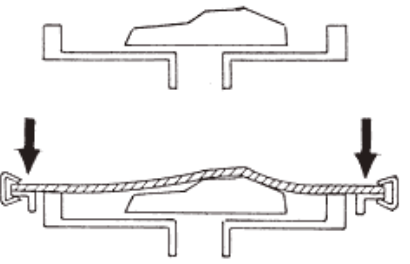
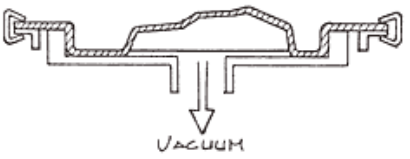
<p>1(b)</p>	<p>Award one mark for each appropriate stage of the process.</p> <ol style="list-style-type: none"> 1. Coniferous logs are saturated in water (1) 2. Timber is debarked(1) 3. cut into chips/pieces (1) 4. Logs are ground down into a pulp (1) 5. The pulp is screened to 1-2mm (1) 6. Larger pieces are recirculated and ground further (1) 7. Pulp is bleached (1) <p style="text-align: right;">4 x 1</p> <p>Note : accept 'treated with chemicals' if relates to bleaching.</p> <p>Note: Marks are only awarded for the production of the pulp</p>	<p style="text-align: center;">(4)</p>
<p>1(c)</p>	<p>Award one mark for an appropriate advantage, and further marks for expansion.</p> <ol style="list-style-type: none"> 1. Chemical pulp contains has longer/stronger fibres (1) resulting in a pulp which can be used for higher grade papers (1) 2. Chemical pulp has fewer impurities (1) whereas mechanical pulp often contains shives/bundles of fibres (1) 3. Chemical pulp results in high quality paper (1) whilst mechanical pulp results in paper which tends to 'yellow'/discolour over time (1) 4. Reduces lignin content (1) to prevent discolouration of paper/improves quality of the paper (1) <p style="text-align: right;">1 x 2</p>	<p style="text-align: center;">(2)</p>
<p>Total for question</p>		<p style="text-align: center;">12</p>

Question Number	Answer	Mark								
2(a)	<p>Award one mark for each risk, and one mark for an appropriate control measure, up to a maximum of four marks</p> <table border="1" data-bbox="268 398 1257 1279"> <thead> <tr> <th data-bbox="268 398 644 461">Risk</th> <th data-bbox="644 398 1257 461">Control Measure</th> </tr> </thead> <tbody> <tr> <td data-bbox="268 461 644 696"> <ul style="list-style-type: none"> ▪ Back strain(1) ▪ Back pain (1) </td> <td data-bbox="644 461 1257 696"> <ul style="list-style-type: none"> ▪ Fully adjustable chair (1) ▪ Footrests (1) ▪ Tilt and turn screens (1) ▪ Use of signage / training(1) ▪ Correct posture (1) ▪ Take appropriate exercise (1) </td> </tr> <tr> <td data-bbox="268 696 644 1010"> <ul style="list-style-type: none"> ▪ Eye strain (1) ▪ Eye ache(1) ▪ Damaged vision (1) </td> <td data-bbox="644 696 1257 1010"> <ul style="list-style-type: none"> ▪ Screen filters can be fitted (1) ▪ Screens which do not flicker (1) ▪ Take regular breaks (1) ▪ Suitable lighting/reduce glare (1) ▪ Distance/Position of monitor (1) ▪ Adjust brightness (1) ▪ Use of signage / training (1) ▪ Wear glasses (1) </td> </tr> <tr> <td data-bbox="268 1010 644 1279"> <ul style="list-style-type: none"> ▪ RSI (Repetitive Strain Injury) (1) ▪ Carpel tunnel syndrome (1) ▪ Hand /finger strain (1) ▪ Aching wrists (1) </td> <td data-bbox="644 1010 1257 1279"> <ul style="list-style-type: none"> ▪ Correct posture (1) ▪ Gel wrist supports (1) ▪ Take regular breaks (1) ▪ Ergonomic keyboard/mouse (1) ▪ Adjustable chair/desk (1) </td> </tr> </tbody> </table> <p>Do not accept signage for multiple responses</p> <p style="text-align: right;">4 x 1</p>	Risk	Control Measure	<ul style="list-style-type: none"> ▪ Back strain(1) ▪ Back pain (1) 	<ul style="list-style-type: none"> ▪ Fully adjustable chair (1) ▪ Footrests (1) ▪ Tilt and turn screens (1) ▪ Use of signage / training(1) ▪ Correct posture (1) ▪ Take appropriate exercise (1) 	<ul style="list-style-type: none"> ▪ Eye strain (1) ▪ Eye ache(1) ▪ Damaged vision (1) 	<ul style="list-style-type: none"> ▪ Screen filters can be fitted (1) ▪ Screens which do not flicker (1) ▪ Take regular breaks (1) ▪ Suitable lighting/reduce glare (1) ▪ Distance/Position of monitor (1) ▪ Adjust brightness (1) ▪ Use of signage / training (1) ▪ Wear glasses (1) 	<ul style="list-style-type: none"> ▪ RSI (Repetitive Strain Injury) (1) ▪ Carpel tunnel syndrome (1) ▪ Hand /finger strain (1) ▪ Aching wrists (1) 	<ul style="list-style-type: none"> ▪ Correct posture (1) ▪ Gel wrist supports (1) ▪ Take regular breaks (1) ▪ Ergonomic keyboard/mouse (1) ▪ Adjustable chair/desk (1) 	(4)
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2(b)	<p>Award one mark for each appropriate reason and one mark for expansion.</p> <ol style="list-style-type: none"> 1. Investigations may be carried out by the company or HSE (1) risk assessments will provide evidence of safe working practices being applied (1) 2. Risk assessments will be used on a regular basis (1) therefore they do not need to be carried out each time (1) 3. Health and safety legislation (1) makes it a requirement to keep risk assessments (1) 4. Similar activities may be carried out using the same equipment (1) meaning an existing risk assessment can be adapted (1) 5. It is a requirement to conduct regular reviews (1) to ensure that the risk assessments remain effective (1) 6. Risk assessments are working documents (1) that employees refer to for safe working practices /potential risks (1) 	(2)								
Total for question		6								

Question Number	Answer	Mark
3(a)	<p>Award one mark for each relevant point, up to a maximum of four marks.</p> <ol style="list-style-type: none"> 1. A colour bar/design is printed with normal inks on the battery (1) black thermochromic liquid crystals are then printed over this (1) 2. A circuit is completed between the pressure points on the battery which causes a small amount of electricity/current to flow (1) 3. The flow of electricity generates heat (1) that makes the thermochromic liquid crystals become clear/change colour (1) 4. A design underneath is revealed (1) which shows how much charge remains in the battery (1) 5. The greater the amount of charge remaining, the higher the temperature (1) this would cause more sections of the TLC to become transparent (1) <p style="text-align: right;">2 x 2</p>	(4)
3(b)	<p>Award one mark for identifying valid points, up to a maximum of five marks.</p> <ol style="list-style-type: none"> 1. products are able to be tracked throughout the entire supply chain (1) 2. scanning in factories shows production levels (1) 3. scanning in warehouse allows ASAR vehicles to operate autonomously/record stock levels (1) 4. deliveries of products are able to be monitored / automatically updates stock levels(1) 5. tags are able to store data/information about the product/price (1) 6. shelf stackers can record stock levels (1) 7. Information is passed to retailers/manufacturers when a product is sold (1) 8. buying habits can be tracked/monitored by the retailer/manufacturer (1) 9. Allows for supply chain integration (1) 10. Allows for automated re-ordering of products by retailers (1) 11. technology will allow consumer to scan products at home and add to online shopping list (1) <p style="text-align: right;">5 x 1</p>	(5)
Total for question		9

Question Number	Answer	Mark
4(a)	<p>Award one mark for each appropriate stage of the process.</p> <ol style="list-style-type: none"> 1. Unwanted areas/waste vinyl is removed/weeded out (1) 2. Apply transfer/application/special tape to the image (1) 3. Remove vinyl on transfer tape from backing sheet (1) 4. Clean the surface of the van (1) 5. Mark out position on the van (1) 6. Use of water/wetted surface to float/slide vinyl into correct position (1) 7. Use transfer tape to apply the image to the vehicle (1) 8. Use squeegee/rubber blade to remove any air pockets/excess water underneath vinyl (1) 9. Apply heat/hot air (1) 10. Remove transfer tape (1) 11. Repeat the process for other colours (1) 12. Carry out visual check/correct imperfections (1) <p>Process needs to be in the correct order to be awarded full marks</p> <p style="text-align: right;">4 x 1</p>	(4)

Question Number	Answer	Mark
4(b)	<p>Award one mark for identifying an advantage/disadvantage and one mark for expansion, up to a maximum of two marks for each.</p> <p>Advantages</p> <ol style="list-style-type: none"> 1. Text and images can be manipulated/changed relatively easily which allows for precise positioning to create a final design / correct design errors (1) 2. Software is intuitive to use (1) allowing less experienced users to create effective designs (1) 3. Software features embedded fonts/images (1) which can allow designs to be produced more efficiently (1) 4. The software allows the design to be resized (1) so it can be manufactured to fit on different sizes of vehicle (1) 5. Allows for repeated design/ templates are available for common vehicles (1) which reduces development time (1) 6. Able to zoom in/out to view fine details (1) to allow work to be carried out in finer detail (1) 7. could be emailed to client (1) allowing immediate feedback/decisions (1) 8. Images can be imported into the design (1) allowing for company logos to be incorporated/personalised (1) 9. Basic software could be inexpensive (1) keeping overall production costs low (1) <p>Disadvantages</p> <ol style="list-style-type: none"> 1. The software/computer systems can be expensive to buy (1) which adds to the overheads/cost of signage (1) 2. Might not be possible to plot/cut designs direct from the software (1) meaning files will need to be converted before manufacturing (1) 3. Company dependent on uninterrupted performance of ICT systems (1) because failure of systems will prevent work being carried out/cause losses to company (1) 4. Software often needs to be updated (1) meaning staff need to be retrained (1) 5. Distorted final image (1) because of the shape of the van (1) 6. Basic software lacks advanced features (1) limiting design creativity (1) 7. Some specialist packages are more expensive/complex (1) increasing design overheads/expertise in use (1) <p style="text-align: right;">1 x 2 1 x 2</p>	<p style="text-align: center;">(4)</p>
	Total for question	8

Question Number	Answer	Mark
5(a)	<p>Award one mark for each stage described</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>1</p>  </div> <div> <p>1. The former placed on the platen (1)</p> </div> </div> <div style="display: flex; align-items: flex-start; margin-top: 10px;"> <div style="margin-right: 20px;"> <p>2</p>  </div> <div> <p>2. thermoplastic is clamped to the machine (1)</p> </div> </div> <div style="display: flex; align-items: flex-start; margin-top: 10px;"> <div style="margin-right: 20px;"> <p>3</p>  </div> <div> <p>3. The polymer is prestretched (1)</p> <p>4. Heat is applied to the thermoplastic until it softens (1)</p> <p>5. A short burst of air is blown under the thermoplastic (1)</p> <p>6. The thermoplastic is lowered/platen raised (1)</p> <p>7. A vacuum is applied to remove air from between the former and thermoplastic (1)</p> <p>8. Thermoplastic is allowed to cool (1)</p> <p>9. Thermoplastic is taken out of the machine/former removed (1)</p> <p>10. Excess plastic trimmed (1)</p> <p style="text-align: right;">4 x 1</p> </div> </div>	

Maximum 3 marks if no sketches
Maximum 3 marks for only simple labels/no annotations.

<p>5(b)</p>	<p>Award one mark for each advantage/disadvantage, and one mark for expansion.</p> <p>Advantages</p> <ol style="list-style-type: none"> 1. Signs will be made consistently (1) as the signage will be made in one piece (1) 2. Set up costs are relatively low (1) as only a male/one former needs to be made/inexpensive machine compared to other processes (1) 3. Lower temperatures are needed for forming (1) which can speed up the production process/reduce energy usage/reduce energy costs (1) 4. The process is suitable for small batch production/one-off production (1) allowing new signs to be produced as new stores are opened (1) 5. Flexible manufacturing process (1), formers are easily made/modified/adapted/range of polymers can be used (1) 6. simple former required (1) allowing for shorter lead times (1) 7. Suitable for hollow shapes / open backed designs (1) to produce a lightweight product (1) 8. Former / mould can be re-used (1) to reduce unit cost on large production runs (1) <p>Do not accept speed of manufacturing.</p> <p>Disadvantages</p> <ol style="list-style-type: none"> 1. Signs may not be strong/may need extra strengthening (1) because vacuum forming is only suitable for materials up to 15mm thick (1) 2. Different parts of the signs will be of different thicknesses (1) meaning that some areas might let light shine through (1) 3. Incorrect temperatures can cause webbing of the moulding (1) which results in wastage (1) 4. Undercutting not possible / intricate designs are hard to produce (1) which therefore restricts the shape the sign can be (1) 5. Slower processes than named alternatives (1) due to heating and cooling time of material (1) 6. Requires significant post production processes i.e. trimming (1) which adds to manufacturing time/costs (1) 7. Lots of waste is cut away from the product (1) adding to production costs / environmental impact (1) 8. The sign will need to be made in 2 parts (1) requiring a secondary assembly process (1) <p style="text-align: right;">1 x 2 1 x 2</p>	<p style="text-align: center;">(4)</p>
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<p>5(c)</p>	<p>To gain full marks, the response should consider each of the types of properties and consider factors both for and against the use of steel.</p> <p>Maximum of four marks for a response that considers only one type of property.</p> <p>Maximum of five marks for a response that considers only two types of property.</p> <p>Maximum of five marks for a response that considers only advantages/disadvantages.</p> <p>Aesthetic properties</p> <ol style="list-style-type: none"> 1. Can have different finishes/paints applied to match corporate identity (1) 2. Could be formed/bent into a decorative shape to add to the design of the sign (1) 3. Will become rusty/unsightly if not coated/painted (1) 4. Coating can degrade over time and need to be repaired or replaced (1) <p>Functional properties</p> <ol style="list-style-type: none"> 1. Parts can be welded together (1) 2. Steel can be formed/bent to the shape needed to support the sign (1) 3. It will not react with the thermoplastic used for the main body of the sign (1) 4. Difficult to maintain if the steel becomes damaged (1) 5. The bracket is more likely to need to be replaced as repairs could be difficult to achieve (1) 6. Heavier than aluminium for example/adds weight to sign/requires stronger fixings (1) 7. Can be drilled for screws (1) 8. Can be recycled (1) <p>Mechanical properties</p> <ol style="list-style-type: none"> 1. High tensile strength/ will not deform with the weight of the sign (1) 2. Will not be easily damaged by wind loading (1) 3. Relatively high fatigue resistance, therefore unlikely to break when exposed to high winds (1) 4. Steel is rigid/ will not bend when loaded (1) 5. difficult to form without specialist equipment/lots of heat/energy (1) 6. durable so wont need replacing regularly (1) 7. Corrosion may reduce the mechanical properties of the steel (1) <p>Do not accept 'strong' unless qualified</p> <p>Comments may be made in the positive or negative. These should be rewarded as appropriate.</p> <p style="text-align: right;">6 x 1</p>	<p style="text-align: right;">(6)</p>
Total for question		14

Question Number	Answer	Mark
<p>6(a)</p>	<div data-bbox="363 304 1110 1211" data-label="Image"> <p>The image shows a technical drawing of a spray bottle. At the top is a plan view (top-down) showing the rectangular body and the internal spray mechanism. Below it are two side views: a front view on the left showing the handle and the spray nozzle, and an end view on the right showing the profile of the bottle and the nozzle.</p> </div> <p>Award up to three marks as follows:</p> <ol style="list-style-type: none"> 1. Correct shape and proportion of the front view (1) 2. Correct outline shape, proportion and relative location of the plan view (1) 3. Correct outline shape, proportion and relative location of the end view (1) <p>Then a maximum of three additional marks for the following features, drawn in the correct location and to the correct proportions, on at least the front view:</p> <ol style="list-style-type: none"> 1. handle (1) 2. plunger/lid (1) 3. screw cap (1) <p>Single view responses, or inaccurate layout of all views, can achieve a maximum of four marks.</p> <p style="text-align: right;">6 x 1</p>	<p>(6)</p>

<p>6(b)</p>	<p>Award one mark for a valid point, with a second mark for expansion</p> <ol style="list-style-type: none"> 1. It can be translucent (1) allowing the level of the contents to be seen (1) 2. It is durable (1) so the bottle can withstand rough handling (1) 3. It is chemically resistant (1) so it will not get damaged by the contents of the bottle (1) 4. Excellent barrier to moisture/waterproof (1) preventing liquid entering/leaving the bottle (1) 5. Possible to add pigment to change the colour (1) to match corporate identities/colour schemes/provide visual impact (1) 6. HDPE is tough (1) which is important for large bottle containing liquid / needs to resist dropping(1) 7. Rigid once formed into shape (1) so the bottle will not deform when full (1) 8. Lightweight material (1) therefore does not add undue weight for transportation/use (1) 9. Recyclable material (1) reduces environmental impacts / waste going to landfill (1) <p>Do not accept 'strong' DO NOT ACCEPT REFERENCE TO BEING ABLE TO BE MOULDED</p> <p style="text-align: right;">2 x 2</p>	<p>(4)</p>
<p>6(c)</p>	<p>Award one mark for each valid statement, up to a maximum of five marks.</p> <ol style="list-style-type: none"> 1. Surface of the mould should be checked for flaws/damage/cleanliness (1) 2. Check that tool vents are clear (1) 3. Make sure there is a water supply for cooling (1) 4. Make sure the polymer is the correct colour (1) 5. Check there is sufficient polymer available (1) 6. Check it is the correct polymer (1) 7. Make sure that the polymer is dry / free from contaminants (1) 8. Check the operation/opening and closing/alignment of the mould (1) 9. Check the function of the Archimedean screw/ram (1) 10. Check density of pellets by weighing measured volume (1) 11. Check IM machine is free from contaminants with a test run/visual inspection (1) 12. Check pressure of the ram is sufficient to fill the mould (1) 13. Check safety features/guards/stops/cage are working/in position with a test run/visual inspection (1) 14. Check machine is reaching correct temperature with IR thermometer (1) 	<p>(5)</p>
<p>Total for question</p>		<p>15</p>

Question Number	Answer	Mark
7	<p>A balanced response must be put forward. Consideration of both positive and negative aspects must be included for full marks. Maximum of five marks if only advantages /disadvantages considered.</p> <p>Advantages</p> <ol style="list-style-type: none"> 1. Able to measure in three axes/X,Y,Z axes (1) 2. Range of inputs can be used - CMM/ cameras/scanner/densitometer/lasers (1) 3. Measurements are recorded by the computer (1) 4. Can be used to repeatedly measure identical parts (1) 5. All items are inspected/checked/100% inspection (1) 6. Computers can act on feedback from sensors to adjust the manufacturing process / identify errors earlier (1) 7. Can result in higher quality outcomes/fewer mistakes/faulty products (1) 8. In some systems there is no physical contact between the product and the sensor (1) 9. Reduces the need for manual inspection of products (1) 10. Production rates can increase due to the lack of manual inspections (1) 11. Reduced labour costs as now checks completed by machine (1) 12. Able to identify faulty components/products and cause production line to automatically eject them (1) 13. Monitors machines and predicts when they are likely to fall out of tolerance (1) 14. More reliable, do not require breaks/rests/can work 24/7 / automated(1) 15. Can work to very small tolerances identifying problems at a very small scale / reduces human error(1) 16. Allows automated analysis of quality control data (1) <p>Disadvantages</p> <ol style="list-style-type: none"> 1. Initial set up cost for the system is high (1) 2. Staff would require training in the use of the system (1) 3. Costs of the system may be more than the savings made through reducing errors (1) 4. Increasing the speed of inspections can result in loss of accuracy (1) 5. There could be compatibility issues between systems (1) 6. System failure can delay production (1) 7. Cannot test every element of a specification (1) 8. Loss of jobs due to workers being replaced by machine checks (1) 9. Struggles to detect unexpected errors outside programming which might be noticed by a human (1) 10. Incorrect calibration can lead to errors in the checking process (1) 	(6)
Total for question		6

