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Mark Scheme (Results)

Summer 2015

Pearson Edexcel
GCE Design and Technology
Product Design: Resistant Materials Technology (6RM02)

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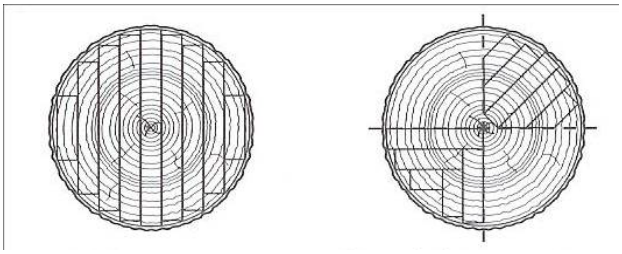
General Marking Guidance

- 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.

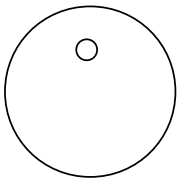
Question Number	Answer	Mark
1(a)	The following answer: 1. Hacksaw (1) 2. Junior hacksaw (1) (1 x 1)	**(1)**
1(b)	Any one of the following: 1. Carbon steel/tool steel (1) 2. High carbon steel (1) 3. High speed steel/tungsten steel (1) Do not accept **steel** without qualification (1 x 1)	**(1)**
1(c)	The following two points: 1. Heat to bright red /above 800 deg/above critical point /high temperature. (1) 2. Cooled fast / quenched / in water / oil (1) Do not accept just '**heated'** or '**cooled**' without any qualification. (2 x 1)	**(2)**
1(d)	Any two of the following points: 1. Hardening makes the blade brittle (stressed) (1) 2. Tempering reduce brittleness (stress) (1) 3. Increase toughness (1) 4. So the blade/teeth will not snap / makes the blade more durable when in use (1) (1 x 2)	**(2)**
1(e)	Any five of the following points: 1. Identify the hazards / risks (1) 2. Identify the people at risk / who might be harmed. (1) 3. Evaluate the risks / assess the seriousness of it / likelihood of it happening. (1) 4. Decide / implement / check appropriate control measures / an example of a control measure Eg. guards, PPE, signage, training, maintenance, etc. (1) 5. Record /store the risk assessment (1) 6. Set a review date / regularly review the risk assessment. (1) Note that the order of the points should not be considered. (1 x 5)	**(5)**
	Total for question	**11**

Question Number	Answer	Mark
2(a)	The two following diagrams: Through and through (1)  Quarter sawn (1) Note – Quarter sawn must show individual planks in at least one quarter, not just a quartered log. The arrangement of the planks may vary from that shown above but should show broadly radial cuts. (1 x 2)	**(2)**
2(b)	Any two of the following points with any linked relevant explanation also from the following points: 1. Faster conversion rate. (1) 2. No need to keep re-positioning the log / simple cut pattern / cuts all run in the same direction / less cuts. (1) 3. Cheaper conversion method. (1) 4. Whole / more of the log is used (1) 5. Little waste produced. (1) 6. More planks produced / available for sale. (1) 7. Planks are taken from the whole log width. (1) 8. Wider planks produced. (1) 9. Less edge jointing / manufacturing processes needed. (1) 10. Less skilled labour needed. (1) 11. Fewer trees cut down / reduced deforestation / more eco-friendly / sustainable. (1) Do not award 'easier' 'efficient' 'effective' type answers as these are too vague. Do not accept 'longer lengths' for 'wider planks' or 'profitable'. (2 x 2)	**(4)**
2(c)	One of the following points with a linked relevant explanation: 1. Produces a higher quality plank (1) which is more stable / less likely to warp/bow/ twist/ cup /split (1) as annual rings are closer/ cross grain is shorter. (1) 2. Produces more valuable timber (1) as the figure of the grain is exposed (1) giving improved aesthetics.	

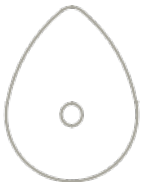
	(1) Award any valid explanation drawn from any of the three elements in each point, but only credit each once. (2 x 1)	**(2)**
	Total for question	**8**

Question Number	Answer	Mark
3 (a)	Any five of the following points : 1. Durable / lasts a long time (1) 2. Light weight / good strength to weight ratio (1) ***But not both**** 3. Corrosion / weather/ water/ chemical resistant (1) 4. Toughness / impact resistant(1) 5. Hardness / scratch resistant (1) 6. Will cast/mould /form (1) 7. Machines / cuts /finishes / shapes easily / well (1) 8. Malleability / plasticity can be pressed/stamped into shape (1) Do not accept 'cheap' or 'widely available' as these are not properties. (5 x 1)	**(5)**
3(b)	Any three of the following checks: 1. Check material quality (with destructive / non destructive tests), eg . strength /toughness/ hardness /durability /corrosion resistant / weight (1) 2. Check function / does it work (freely rotate/smooth running chain) (1) 3. Check that parts fit together (1) 4. Check surface finish (scratches /dents/dirt/blemishes) (1) 5. Check sharp corners/edges (1) 6. Check casting quality (flaws / cracks / flashing / holes / bubbles /miss-forms / broken parts) (1) 7. Check for correct assembly (location/missing components tightness of screws) (1) 8. Check threads are fully cut /formed (1) 9. Check quality of decals/printing / position (1) Do not accept simplistic statements such as 'do a visual check' or 'test it' or 'check it'. (3 x 1)	**(3)**
	Total for question	**8**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>4</td><td>The following responses:-
<table>
<tr><th>Name</th><th>Diagram</th><th>Characteristic</th><th>Use</th></tr>
<tr><td>Eccentric

(1)</td><td>  </td><td>-Gives a continuous/ smooth/consistent /symmetrical motion / even acceleration and retardation.
(not just rise and fall)
(1)</td><td>Fuel pumps</td></tr>
<tr><td>-Pear
-Egg

Do not accept oval

(1)</td><td>  </td><td>Causes follower to dwell for part of the cam’s rotation</td><td>Engines (Valves)
Cars
Fairground rides
Sewing machines

Accept any appropriate situation.

Machines , etc. is too vague.
(1)</td></tr>
</table></td><td>(6)</td></tr>
</table>

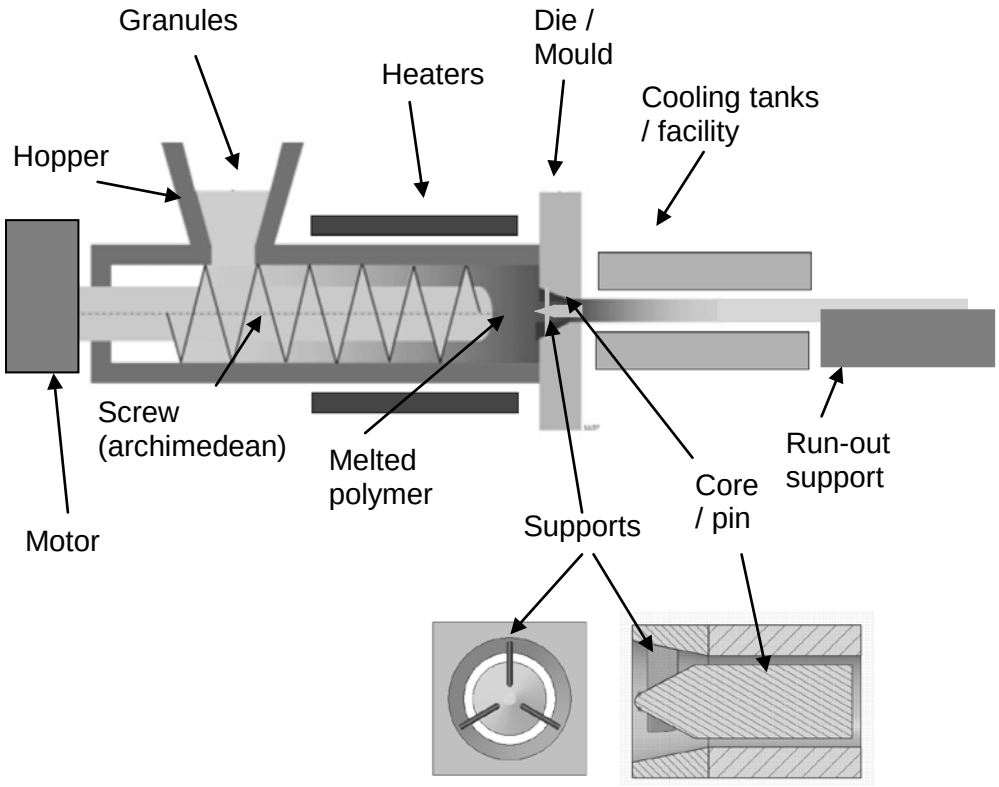
		Snail	○ (1)	-Gives the follower a sudden drop. -Uniform rise. -Will only rotate in one direction (1)	Toys/automata	
					(1 x 6)	
				Total for question		**6**

Question Number	Answer	Mark
5	Any six of the following points: 1. Input material data/type. (1) 2. Set feed rate /speed rate / depth of cut (colours	

	assigned to depths). (1) 3. Process the image into a machine file/ G&M codes/ STL / suitable machining format. (1) 4. Simulate / test run the file on screen. (1) 5. Transfer the data to the CNC machine. (1) 6. Select a suitable / adequate / appropriate / size of / type of material / blank. (1) 7. Material is loaded /clamped /positioned /aligned. (1) 8. Input data of the materials size / height / depth / position (1) 9. Tooling is fitted / changed /set /selected (1) 10. Close guards / doors. (1) 11. Home axis/orientate machine slides/tools/set machine to zero/ calibrate machine. (1) 12. Turn on extraction / coolant system. (1) Accept correct points in any order. Do not accept any general 'check' points, Eg. Check the CAD drawing, check the machine, check the material, check safety issues, etc. (1 x 6)	**(6)**
	Total for question	**6**

Question Number	Answer	Mark

r		
6(a)	Any three of the following points with a linked relevant explanation: 1. Water / chemical / weather /corrosion resistant / durable (1) so that it is not affected by outside conditions /household / industrial waste / will not leak / lasts a long time / easily cleaned / low maintenance. (1) 2. Sunlight /UV resistant (1) so will not become brittle as quickly as other polymers / colour will not fade. (1) 3. Tough (1) so can withstand knocks / bangs. (1) 4. Sufficiently hard (1) so it is not scratched /worn away by flowing contents. 5. Easily moulded / extruded (1) so it can be mass produced economically / made quickly. (1) 6. Flexible (1) so can be fitted to shallow corners / uneven surfaces (1) 7. Lightweight (1) making it easy to transport / does not require substantial mountings. (1) 8. Easily cut / drilled / joined / glued (1) so fitting is simple.(1) 9. Relatively cheap (1) so it can be sold at a competitive rate / high sales /profits. (1) 10. Self-finishing (1) reducing manufacturing / maintenance procedures. (1) 11. Recyclable (1) so reduces demand for raw materials/ does not contribute to land fill. (1) 12. Can be textured (1) to blend with existing architectural styles. (1) 13. Sufficiently high melting point/ heat resistant (1) so is not softened by boiling water / bright sunlight. (1) (3 x 2)	**(6)**

6(b)	Eight of the following points either in the diagram or in the text.  1. Hopper (1) 2. Granules / granules fed in (1) 3. Motor / motor turn screw (1) 4. Screw / screw pushes material along (1) 5. Heaters / granules is heated (1) 6. Polymer melts (1) 7. Die / mould /polymer squeezed through die (1) 8. Cooling tanks / formed shape is cooled (1) 9. Run-out support / tube is supported as it is fed out (1) Max 7 marks from above points. 10. *Core/ pin creates hollow tube (1) 11. *Core supports/ plastic flows round core supports (1) * For full 8 marks at least one of the asterisk points are needed. (8 x 1)	**(8)**
	Total for question	**14**

Question Number	Answer	Mark
7	Any six of the following but must contain at least one disadvantage: **Advantages** 1. Low energy requirement/efficient. (1) 2. Extends battery life/. (1) 3. Lightweight units (1) 4. Thin / small / compact unit / minimal space required. (1) 5. Increased portability. (1) 6. Produce a wide range / 256 colours. (1) 7. Vivid / bright / clear display.(1) 8. Small pixel size allows detailed/ sharp/ high quality / high definition images. (1) 9. Sufficiently robust /tough /can take some impacts / knocks. (1) 10. Reliable/ durable / long-lasting. (1) 11. Can be mass produced cheaply / quickly. (1) 12. They do not get hot. (1) 13. Light is instant/no warm-up time. (1) 14. Reduced eye strain. (1) 15. Powered by small batteries. (1) **Disadvantages** 16. Can be broken from a direct impact / relatively easily.	

	(1) 17. Limited viewing angle. (1) 18. Expensive to replace / high maintenance cost / difficult to fix. (1) 19. Can suffer from image persistence / retention. (1) 20. A small damaged area can affect the whole screen. (1) (6 x 1)	**(6)**
	Total for question	**6**

Question Number	Answer	Mark
8(a)	Any two of the following properties each with a linked relevant explanation: 1. Sufficient strength / uniform strength (1) due to laminates being glued together /alternating grain / to take the weight of a person. (1) 2. Tough (1) impact resistant / will not split if knocked over. (1) 3. Sufficient hardness / durable (1) to resist significant denting and scratching (Eg. studded clothing) / wear / last a long time. (1) 4. Sufficiently soft (1) so that it can be drilled/screwed to attach to frame / easy to cut to shape / work with. (1) Do not accept aesthetic and functional properties or characteristics, eg cheap, stable, lightweight, easily finished, widely available, etc.	**(4)**

	(2 x 2)	
8(b)	Any seven of the following but must include one from each to gain full marks: **Negatives** 1. Running QC systems costs extra money /reduces profits. (1) 2. Increases selling price / price themselves out of the market / competitor products are cheaper. (1) 3. Set up costs eg. Equipment / training costs. (1) 4. Running costs eg. Labour/ energy /maintenance/ destructive testing/ etc. (1) 5. Slower production rate / time consuming / time needed to check every component / less products manufactured / sold. (1) **Positives** 6. High quality / more reliable products produced. (1) 7. Good reputation/quality marks gained (BSI, ISO4000, etc). (1) 8. Leading to increased profits /higher value product / increased sales / money saved. (1) 9. Less returned products/ replacement products supplied. (1) 10. Sampling / computer driven /automated monitoring systems are cheaper to run.(1) 11. Increased QC checks will reduce the waste incurred when faulty goods are further processed/ faulty goods are disposed of / leads to increased productivity. (1) Accept points stated in reverse, but do not award each twice eg increased sales due to high quality reputation / reduced sales due to poor quality reputation (1) (7 x 1)	**(7)**
	Total for question	**11**