

# **Design and Technology**

General Certificate of Secondary Education

Unit **A514/03** Technical aspects of designing and making Mechanisms

## **Mark Scheme for January 2012**

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Any enquiries about publications should be addressed to:

OCR Publications  
PO Box 5050  
Annesley  
NOTTINGHAM  
NG15 0DL

Telephone: 0870 770 6622  
Facsimile: 01223 552610  
E-mail: [publications@ocr.org.uk](mailto:publications@ocr.org.uk)

| Question |     |       | Answer   | Marks     | Guidance   |
|----------|-----|-------|--|-----------|--|
|          |     |       | <b>Section A</b>   |           |  |
| 1        | (a) | (i)   | Any two of: Sustainable, flexible, long working, zero emissions, 24/7/365 by arrangement.  | 2         | Not cheap, cheaper, more reliable.   |
|          |     | (ii)  | Glass filled nylon, nylon, polypropylene, HD Polyethylene, Any suitable (for external use) thermoplastic.  | 1         | Allow 're-cycled plastic' but not Polystyrene, HIPS, due to UV degradation   |
|          |     | (iii) | So that/because it can be Injection moulded/thermoformed.  | 1         | Allow rotational moulding, 'moulded' 'melted into shape'. NOT looking for 'can be recycled after use or if broken' or strong. If nylon specified, allow self-lubricating. Not lighter, easier to shape etc.  |
|          | (b) | (i)   | $36/6 = 6:1$   | 2         | Do accept '6' alone, ratio no required, but not 1.   |
|          |     | (ii)  | $30/6 = 5$   | 2         | Allow 2 marks for '5' alone  |
|          |     | (iii) | Any of makes it easier to turn the drum, less effort needed, less (instantaneous) work, offers mechanical advantage.   | 1         | Not 'easier', or similar unless qualified. 'More precise' implies understanding of the principles, so allow.   |
|          | (c) |       | Looking for a belt (any sort) or chain, linking small pulley on motor (allow just drawn round shaft) to a much bigger pulley (allow around the actual drum itself) such that the system could work.<br>If alternatives are offered (crank) that could work, maximum 2 marks unless gearing included. | 3         | Akin to a tumble dryer or a washing machine. Must be a feasible and clearly drawn solution for full 3 marks. Indistinct or ambiguous arrangements around the motor body for instance do not score. If a single line drawn between motor and drum, no marks. If two lines that loosely form a belt, 1 mark. If gearing down shown 2 marks, 3 marks for gearing down and some indication of chain, belt type, pulleys etc. |
|          |     |       | <b>Question 1 Total</b>  | <b>12</b> |  |
| 2        | (a) |       | Safety goggles, face protection (full face visor) hand protection, leather apron, safety guard (unspecified), take care with mains electricity/cable, ensure work is secured.  | 2         | Allow gloves, leather (or specified HD gloves) 'Goggles' Ok for one mark.  |
|          | (b) |       | Zinc plating (both electroplated and hot dip galvanising)<br>Disadvantages: Does not take paint well, needs removal prior to welding, may increase thickness.  | 4         | <b>4x1</b>   |

| Question | Answer   | Marks     | Guidance  |
|----------|--|-----------|---|
|          | <p>Powder coating Advantages: complete coverage, hard wearing, weatherproof easy to apply.</p> <p>Powder coating Disadvantages: corrosion from small scratches (can lead to large areas flaking off), difficult to touch up or repair local damage, only 1 colour per item</p> <p>Spray Painting Advantages: Wide range of colours and types of finish (metallic, metalflake, pearlescent) blending of colours possible.</p> |           |   |
| (c)      | <p>Looking for consideration of and comments relating to the working properties and behaviours of these two metals. Must relate to industry or industrial applications, e.g. cars, aeroplanes, structures, with reference to their relative costs, corrosion resistance, weight, working properties and manufacturing methods.</p>   | 6         | <p><b>Level 1 (0-2 marks)</b><br/>Basic description, showing some understanding of working properties and behaviours involved. There will be little or no use of specialist terms.<br/>Answers may be ambiguous or disorganised or 'list like'.<br/>Errors of grammar, punctuation and spelling may be intrusive.</p> <p><b>Level 2 (3-4 marks)</b><br/>Adequate description, showing an understanding of working properties and behaviours involved. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation</p> <p><b>Level 3 (5-6 marks)</b><br/>Thorough description, showing clear understanding of working properties and behaviours involved. There will be three or more clearly identified and explained points. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate will demonstrate the accurate use of spelling, punctuation and grammar.</p> |
|          | <b>Question 2 Total</b>  | <b>12</b> |   |

| Question |     |       | Answer  | Marks   | Guidance  |
|----------|-----|-------|---|---|---|
| 3        | (a) | (i)   | Effort, anywhere on the wooden handles,<br>Fulcrum, hinge joint at extreme left hand side<br>Load, nut (or anywhere along serrated jaws except at the point where they would close).                  | 3   | 3x1   |
|          |     | (ii)  | Class 2, Second.  | 1   |   |
|          |     | (iii) | Stainless steel, 18/8 Stainless   | 1   | Allow chromium plated steel but NOT mild steel.   |
|          |     | (iv)  | Aesthetic or ergonomic reasons, looks nice, nicer to hold,<br>good grip, safety reason, no sharp edges,   | 1   | Not cheaper   |
|          |     | (b)   | (i)   | $500 \times 400 = 200,000$<br>$200,000/1400 = 142\text{NM}$ | 1<br>1  |
|          |     | (ii)  | R-clip, spring clip, snap clip, or anything that implies clipping into place by hand, temporary (fitting/fixing).   | 1   | Not safety pin, pin, allow hairpin, split-pin.  |
|          |     | (iii) | Easy or quick to remove, (by hand) no tools needed to remove, quick release.  | 1   | Not 'cheap', 'simple', 'easy to use' unless justified e.g. 'easy to remove by hand', 'no tools required'. |
|          |     | (iv)  | Any one from hard wearing, scuff resistant, strong (an engineering plastic), self-lubricating, will not harm floors (like cast iron might), can be injection moulded (implying fast/cheap unit cost). | 1   | Not 'cheap', 'light' unless qualified, allow 'strong'.  |
|          |     | (v)   | Less packaging, saving storage space before shipping, lower transport costs when shipped in bulk, less assembly needed.   | 1   | Any valid reason.   |
|          |     |       | <b>Question 3 Total</b>   | <b>12</b>   |   |
|          |     |       | <b>Section A Total</b>  | <b>36</b>   |   |

| Question |     |      | Answer   | Marks     | Guidance  |
|----------|-----|------|--|-----------|---|
|          |     |      | <b>Section B</b>   |           |   |
| <b>4</b> | (a) |      | Lever, class one lever, second class lever.  | 1         |   |
|          | (b) |      | Four arrows indicating (a) movement down on operating lever, (b) opposite end of lever rises (c) pushing angled rod upwards into chicken, causing chicken to tip forwards in general direction of food bowl.   | 4         | <b>4x1</b> Double ended arrows that show correct movement count as 2 such as chicken head moving forwards and backwards, operating arm up and down. |
|          | (c) |      | Any four points: method of location (drawn outline, pair of edges, drop in template), clamping or holding device. Drill of some sort, information showing the two holes, steel drilling template (long life, for accuracy)   | 4         | <b>4x1</b>  |
|          | (d) | (i)  | Choking hazard, may be swallowed, stuck in nose/ear/eye or simply 'easily lost'. Sharp edges, may be too complex/complicated / difficult to understand.  | 2         | <b>2x1</b> Both sound reasons not vague hopeful guesses.  |
|          |     | (ii) | Lead is toxic/poisonous/harmful to human development/cumulative poison.  | 1         | Not 'fumes from paint' or 'fumes as it dries'.  |
|          |     |      | <b>Question 4 Total</b>  | <b>12</b> |   |
| <b>5</b> | (a) | (i)  | (A) Brake calliper, brake pad application device, hydraulic brake, calliper.<br>(B) Disc brake, brake disc, disc/disk/rotor  | 2         | <b>2x1</b> Allow functional description of what a calliper does.  |
|          |     | (ii) | Lightening holes, to save weight, to improve cooling, heat/water/mud dissipation, pad de-glazing, saves materials (in the long run)  | 1         | Allow e.g. name laser cut into disc.  |
|          | (b) |      | Device may be re-programmed/re-used/read remotely<br>Remote or automatic monitoring of competitor passing start/finish line, accurate timing (human error eliminated)<br>easy to distinguish/separate when a group pass through,<br>no arguments about computer timing, Visual and functional, promotional opportunity for suppliers/sponsors. | 3         | <b>3x1</b><br>If answer indicates some tracking capability (locate lost rider) then no mark.  |

| Question | Answer   | Marks     | Guidance  |
|----------|--|-----------|---|
| (c)*     | <p>Identify lost or injured competitors.</p> <p>Looking for discussions or descriptions of simple mechanisms that we make common use of in our lives. Tin-opener, bottle opener, tweezers, wheelbarrow, wheel brace, crowbar, see-saw, crowbar/jemmy, scissors. References to cars (and their many mechanisms), domestic appliances, hand tools with gearing or levers all can score marks. Simple lists of mechanisms score 2 marks maximum. Descriptions of any of the above need to qualified to a degree for marks to be awarded, e.g. washing machine alone scores 0, but reference to the motor, drum and belt would score 1.</p> <p><b>TO BE ADDED TO IN THE LIGHT OF CANDIDATE RESPONSES</b></p> | 6         | <p><b>6X1-</b></p> <p><b>Level 1 (0-2 marks)</b><br/>Basic explanation, showing some understanding of simple mechanisms and how they are commonly used in everyday products. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised or 'list like'. Errors of grammar, punctuation and spelling may be intrusive.</p> <p><b>Level 2 (3-4 marks)</b><br/>Adequate explanation, showing an understanding of simple mechanisms and how they are commonly used in everyday products. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation.</p> <p><b>Level 3 (5-6 marks)</b><br/>Thorough explanation, showing clear understanding of simple mechanisms and how they are commonly used in everyday products. There will be <b>three</b> of more clearly identified and explained points. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate will demonstrate the accurate use of spelling, punctuation and grammar.</p> |
|          | <b>Question 5 Total</b>  | <b>12</b> |   |
|          | <b>Paper Total</b>   | <b>60</b> |   |

**OCR (Oxford Cambridge and RSA Examinations)**  
1 Hills Road  
Cambridge  
CB1 2EU

**OCR Customer Contact Centre**

**Education and Learning**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)

**[www.ocr.org.uk](http://www.ocr.org.uk)**

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