# GCE

# Design and Technology

## H404/02: Problem solving in Design Engineering

A Level

# Mark Scheme for June 2024

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

# MARKING INSTRUCTIONS

## PREPARATION FOR MARKING
## RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

## MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   **Rubric Error Responses – Optional Questions**
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

**Multiple Choice Question Responses**
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
*When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.*

**Contradictory Responses**
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

**Short Answer Questions** (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

**Short Answer Questions** (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

**Longer Answer Questions** (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space

   Award Zero '0' if:
   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following

| Descriptor | Award mark |
|---|---|
| On the borderline of this level and the one below | At bottom of level |
| Just enough achievement on balance for this level | Above bottom and either below middle or at middle of level (depending on number of marks available) |
| Meets the criteria but with some slight inconsistency | Above middle and either below top of level or at middle of level (depending on number of marks available) |
| Consistently meets the criteria for this level | At top of level |

11. **Annotations**

| Annotation | Meaning |
|---|---|
| SEEN | Seen |
|  | Tick |
| REP | Repetition |
| VG | Vague |
|  | Unclear – *Must only to be used if the answer cannot be read / illegible* |
| BOD | Benefit of the doubt (= a mark) |
| L1 | Level 1 |
| L2 | Level 2 |
| L3 | Level 3 |
| L4 | Level 4 |

**Applying the annotations**

Every page must have an annotation stamp on it to indicate you have checked all the pages that are available. If a page is blank, use the 'seen' stamp.

Levels of response questions

- Do **not** use ticks, use the highlighter tool to indicate relevant sections. The number of highlighted sections does **not** equal the number of marks awarded.
- Always stamp the level number at the end of the question, e.g. L2.

12. **Subject Specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet Instructions for Examiners. If you are examining for the first time, please read carefully Appendix 5 Introduction to Script Marking: Notes for New Examiners.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| 1 | | | **Indicative content:**<br><br>Within their answer candidates are expected to refer to both the legislation involved and refer to the British Standards and the effects that they will have on the various stakeholders involved.<br><br>Their answers could include but are not limited to:<br><br>**Legislation:**<br>• Understanding that these are law.<br>• Managers of the play area can be held to account for miss management of their play areas.<br><br>**British Standards:**<br>• Reference should be made to the BS EN1176.<br>• Reference to the minimum standards expected for the play area equipment.<br><br>**For the user:**<br>• Knowing that the materials used in the manufacture of the equipment is to the correct standard and will last the harsh conditions.<br>• Know that the equipment is made to the right spec and safety standards.<br>• Through correct use the equipment is safe to use.<br>• Parents will be reassured that the equipment is safe and are more likely to visit.<br><br>**The play area manager:**<br>• As long as the equipment is maintained correctly, if an accident was to occur they would not be liable for the injury.<br>• Encourage more people to visit and enjoy the area. | **12**<br><br>*Any lifted information can be used in support of the critical examination but no marks should be awarded simply for duplicating text.*<br><br>*Credit should be given for responses which identify the information and examples in the supplied information and which are then analysed and evaluated in terms of their* | **Level 4 [10-12 marks]**<br>A **comprehensive** discussion of the issues that would be considered.<br>Comprehensive understanding of both the legislative and British Standards issues that would be considered. Has considered both the manufacturing and other stakeholders. Information in RB is used effectively to fully exemplify the points being made in relation to **at least three** stakeholders (manufacturing company + 2). Reference should have been made to either the Acts mentioned in the RB (Occupiers liability 1957 and 1984 or H&S at work 1974) and BS EN1176.<br>Well-constructed narrative in relation to question with clear and supported evaluative comments.<br><br>**Level 3 [7-9 marks]**<br>A **good** discussion of the issues that would be considered.<br>A good understanding of both the legislative and British Standards issues that would be considered. Has considered both the manufacturing and other stakeholders.<br>Information in RB is used for the most part effectively to exemplify points being made in relation to at **least three stakeholders** (manufacturing company +2) although one or two opportunities are missed. Reference should have been made to either the Acts mentioned in the RB.<br>Well-constructed narrative in relation to question although one or two opportunities missed to develop response. Evaluative |

| Question | | | Answer | Mark | Guidance |
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| | | | • A prescribed maintenance log can be produced based on the equipment they have to maintain.<br><br>**The manufacturer:**<br>• Increase in confidence in their product due to meeting the safety standards.<br>• Can charge more for the equipment.<br>• Develops confidence in the brand.<br>• Satisfaction of material testing and material quality.<br>• Installation.<br><br>In all cases any other valid suggestion. | *significance to relevant stakeholders.* | comments are clear but not always supported.<br><br>**Level 2 [4-6 marks]**<br>A **sufficient** discussion of the issues that would be considered.<br>A sufficient understanding of both the legislative and British Standards issues that would be considered. May have only considered the manufacturer or other stakeholder.<br>Information in RB is used to exemplify some points being made in relation to at **least two stakeholders** although much more could have been done to exploit the stimulus material available.<br>Reasonable narrative in relation to the question although response at times lacks depth and cohesion. Evaluative comments lack clarity and are unsupported.<br><br>**Level 1 [1-3 marks]**<br>A **limited** discussion of the issues that would be considered.<br>Limited knowledge and next to no understanding of issues that would be considered with reference to either the legislation or British Standards. May have only considered the manufacturer or other stakeholder.<br>Use of information from the RB is used in a simplistic way and adds limited value to the points being made. Any stakeholder referenced. |

| Question | | | Answer | Mark | Guidance |
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| | | | | | Limited response in relation to question. Narrative is basic and unstructured.<br><br>0 marks = No response or no response worthy of credit. |

| Question | | | Answer | Mark | Guidance |
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| 2* | | | **Indicative content:**<br><br>Within their response, candidates would be expected to refer to the equipment being designed as a one-off piece or as small batch, along with specific reference to both the repair and maintenance of the piece.<br><br>The response should consider the 4 key areas of DFM;<br>1) Planning<br>2) Scale of Production<br>3) Repair and Maintenance<br>4) Product Life<br><br>Answers can include but are not limited to:<br><br>**Planning**<br>• Preparation work for the design of the equipment. Looking at the area that they are placing the equipment and designing around that area. Size, Shape, ground type etc. Will it be a natural play area?<br>• Producing accurate plans to enable efficient installation and assembly either onsite or at the factory.<br>• Enable testing and prototyping of the designs prior to expensive manufacture costs.<br><br>**Scale of production:**<br>• Understanding and making reference to the fact that these will be one-off or small batch production. Items will be designed for a specific area and requirement.<br>• Refer to the cost implications of the above in the manufacture and give suggestions on how this can be reduced.<br>• Modular design for the equipment, enabling larger production volume with lower costs.<br>• Enable a 'custom' design for each client meeting the needs of the client and the usable area. | **14**<br><br>*Any lifted information can be used in support of the critical examination but no marks should be awarded simply for duplicating text.*<br><br>*Candidates who **do not** mention all four key areas should only access Level 3 or below.*<br><br>*Reponses should make reference to outdoor play equipment.* | **Level 4 [12-14 marks]**<br>A **comprehensive** discussion of the issues that would be considered.<br>Comprehensive understanding of the considerations when Designing for Manufacture with all four areas covered in relation to the play equipment.<br>Information in RB is used effectively to fully exemplify the points being made.<br>Well-constructed response in relation to question with a clear and developed narrative.<br><br>*There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*<br><br>**Level 3 [9-11 marks]**<br>A **good** discussion of the issues that would be covered.<br>Good level of understanding of the considerations when Designing for Manufacture with three areas covered albeit one or two opportunities are missed to make connections in relation to the play equipment.<br>Information in RB is used for the most part effectively to exemplify points being made although one or two opportunities are missed.<br>Well-constructed response in relation to question although one or two opportunities not taken to develop narrative. |

| Question | | | Answer | Mark | Guidance |
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| | | | • May refer to the outsourcing of the production of parts or the use of bought in components.<br><br>**Repair and Maintenance:**<br>• Consideration should be made for the repair of the equipment once in situ.<br>  ○ Parts should be easily replaced (but use security screws to stop tampering).<br>  ○ Parts should be readily available to reduce costs and ease availability and repair time scales.<br>• Parts should be tested so if they do fail, the chance of injuring the user is reduced. Materials considerations should be thought through.<br>• Replaceable components. Over time some components will require replacing, for example chains or rope of swings will degrade, foot holds and handles will wear down and none slip surfaces will wear. These parts should be easily replaced and be available.<br>• Play areas can also be subject to vandalism. Considerations should be made for this. Can the surfaces be easily repainted or cleaned?<br>• To ensure that the equipment maintains the safety standards set out in BS EN 1176 the equipment should be maintained on a regular basis. The equipment should be designed for this ease of maintenance. Could be through commo tooling, or simple design. Parts should be interchangeable where possible.<br>• Standardised components.<br><br>**Product Life:**<br>• Consideration for the environment that the play equipment will be in, has consideration for this been given when choosing the materials being used?<br>• What is the expected life span of the equipment? | | *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.*<br><br>**Level 2 [5-8 marks]**<br>A **sufficient** discussion of the issues that would be considered.<br>Sufficient understanding of the considerations when Designing for Manufacture, taking into account at least two areas specified in question but there are significant opportunities missed to make connections in relation to the play equipment.<br>Information in RB is used to exemplify some points being made although much more could have been done to exploit the stimulus material available.<br>Reasonable response in relation to the question although narrative at times lacks depth and cohesion.<br><br>*The information has some relevance and is presented with limited structure. The information is supported by limited evidence.*<br><br>**Level 1 [1-4 marks]**<br>A **limited** discussions of the issues that would be considered.<br>Limited knowledge and understanding of Designing for Manufacture with limited understanding of the areas needed in relation to the play equipment (one at best). |

| Question | | | Answer | Mark | Guidance |
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| | | | • Who is the intended market of the equipment, is it likely to be used by other user groups?<br>• How often will the equipment be used?<br>• Mention of replacing parts to extend product life.<br><br>In all cases any other valid suggestion. | | Use of information from the RB is used in a simplistic way and adds limited value to the points being made.<br>Limited response in relation to question.<br>Narrative is basic and unstructured.<br><br>*The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.*<br><br>0 marks = No response or no response worthy of credit. |

| Question | | | Answer | Mark | Guidance |
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| 3 | (a) | (i) | Diameter of rope in metres = 12/1000 = 0.012m [1]<br><br>Cross-sectional area = $\pi d^2/4 = \pi \times 0.012^2 / 4 = 1.13 \times 10^{-4}$* $m^2$ [1] | 2 | Award two marks as follows:<br><br>One mark for calculating the diameter of the rope in metres.<br><br>One mark for calculating the cross-sectional area of the rope to **3** significant figures.<br><br>If correct answer is given without working out shown award full marks.<br><br>Where an incorrect answer is given working out should be used to credit appropriate marks.<br><br>*Allow error carried forward (ECF) where correct working out is shown.<br><br>Allow 0.000113 $m^2$<br><br>Allow use of $\pi r^2 = \pi \times 0.006^2$ |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| | | **(ii)** | Weight of child = mg = 78 x 9.81 = 765.18N [1]<br><br>Force in each rope = child's weight / 2<br>= 765.18 / 2 = 382.59N [1]<br><br>Recall of formula: stress = force / cross-sectional area to calculate: [GIVEN]<br><br>Stress = 382.59 / 1.13 x $10^{-4}$ = 3385752 $N/m^2$ [1]<br><br>Convert to MPa: 3385752 / $10^6$ = 3.39 MPa (rounded to 2dp) [1] | 4 | Award four marks as follows:<br><br>One mark for showing how to determine the weight of the child.<br><br>One mark for showing how to determine the force acting on each rope.<br><br>One mark for using the correct formula to show the stress on one of the swing ropes.<br><br>One mark for showing how to covert answer to MPa.<br><br>Working MUST be clearly shown to gain credit, as the final answer is given in the question. |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| | | **(iii)** | Strain = stress / Young's Modulus = $3.39 \times 10^6$ / $480 \times 10^6$<br>Strain = 0.0070625 [1]<br><br>From Fig 5 in RB:<br>Original length of rope = 2010 – 500 = 1510mm ([1]<br><br>Extension of rope = original length x strain<br>= 1510* x 0.0070625*<br>= 10.7*mm (to 1dp) [1] | 3 | Award three marks as follows:<br><br>One mark for using the correct formula to calculate the strain.<br><br>One mark for calculating the original length of the rope.<br><br>One mark for calculating the extension of a swing rope to **1** decimal place caused by a stress of 3.39 MPa.<br><br>If correct answer is given without working out shown award full marks.<br><br>Where an incorrect answer is given working out should be used to credit appropriate marks.<br><br>*Allow error carried forward (ECF) where correct working out is shown. |

| Question | | | Answer | Mark | Guidance |
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| | **b** | | Calculate the length of the cutting path:<br><br>Outside path length:<br><br>(700x2) + (500x2) = 2400 mm [1]<br><br>**Inlay path length: 1260 mm [GIVEN]**<br><br>Total cutting path = 2400* + 1260 = 3660 mm [1]<br><br>Time to cut the path = 3.660*/0.6 = **6.1* minutes** [1] | 3 | Award three marks as follows:<br><br>One mark for calculating outside path length.<br><br>One mark for calculating total cutting path,<br><br>One mark for calculating time to cut path in minutes.<br><br>If correct answer is given without working out shown award full marks.<br><br>Where an incorrect answer is given working out should be used to credit appropriate marks.<br><br>*Allow error carried forward (ECF) where correct working out is shown. |

| Question | | | Answer | Mark | Guidance |
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| 4 | | | **Indicative Content:**<br><br>**Issue 1**<br>Candidates should design an electrical system that will detect the light level using the sensor given in the resource booklet and then operate the linear solenoid given in the resource booklet.<br><br>They could use but are not limited to:<br><br>**Input: (up to 2 marks)**<br>• Ensure that the candidates are using a Potential divider with the LDR.<br>• A suitable resistor should be used as a pull up resistor to enable to output to be high when it is dark.<br>• Choice of resistor should match the data given in the RB. Resistance of LDR:<br>@10 lux = 20k<br>@100 lux = 5k<br>So a resistor in the range 1k to 100k would be suitable.<br>Candidate must explain/justify the choice to gain full credit.<br><br>**Process (up to 3 marks)**<br>• Microcontroller – with flow chart showing operation.<br>• Transistor circuit – With circuit diagram.<br>• Darlington pair– With circuit diagram.<br>• Comparator (op-amp) – With circuit diagram.<br><br>**Output (up to 3 marks)**<br>To power the solenoid candidates should recognise that they will require the use of a driver. E.g.<br>• Transistor (MOSFET or bipolar transistor).<br>• L293D motor driver IC.<br>• Darlington pair.<br>Candidates are expected to draw the circuit out lining each of the above clearly. Commentary can be used to outline the processes but is not required for a level 4 response. | **16**<br><br>**8 – issue 1**<br>**8 – issue 2**<br><br>Award a maximum of 8 marks For Issue 1<br><br>*To do this candidates must **not** use a micro controller, award 0 marks if a candidate has used a micro controller in their response.* | **Issue 1**<br>**Level 4 [7-8 marks]**<br>A **comprehensive** demonstration of technical solutions to overcome the issue identified.<br>Comprehensive understanding of technical design and technology principles to overcome the issue identified. Solution is well-developed.<br>Response for Issue 1 should be a correctly drawn circuit using correct circuit symbols and components in the correct places.<br>Information in RB is used effectively to fully exemplify the points being made.<br>Sketches if used will be clear and supported with relevant notes.<br>The process will be end to end and clear in the way it is explained.<br><br>**Level 3 [5-6 marks]**<br>A **good** demonstration of technical solutions to overcome the issue identified.<br>Good understanding of technical design and technology principles to overcome the issue identified. Solution shows a good level of development.<br>Response for Issue 1 should be a correctly drawn circuit using correct circuit symbols and components with the vast majority correct placed.<br>Information in RB is used for the most part effectively to exemplify points being |

| Question | | | Answer | Mark | Guidance |
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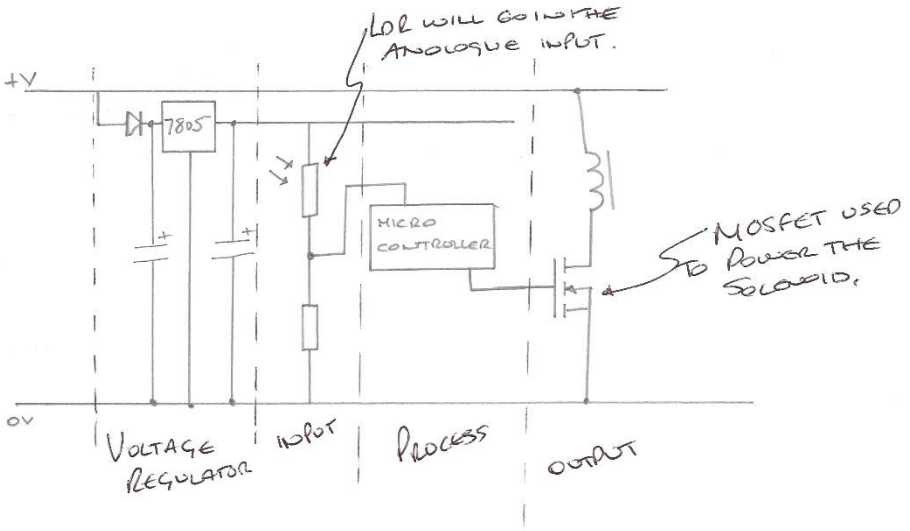
| | | |  | | made although one or two opportunities are missed.<br>Sketches will for the most part be clear and supported with relevant notes.<br>The process will be end to end and for the most part be clear in the way it is explained.<br><br>**Level 2 [3-4 marks]**<br>A **sufficient** demonstration of technical solutions to overcome the issue identified. Sufficient understanding of technical design and technology principles to overcome the issue identified. Solution shows sufficient development but one or two opportunities missed.<br>Response for Issue 1 should be a circuit which has the input/process/output identified and uses mostly correct circuit symbols.<br>Information in RB is used to exemplify some points being made although much more could have been done to exploit the stimulus material available.<br>Sketches will be adequate and supported with notes.<br>The process may not necessarily be end to end with some knowledge gaps evident. |

| Question | | | Answer | Mark | Guidance |
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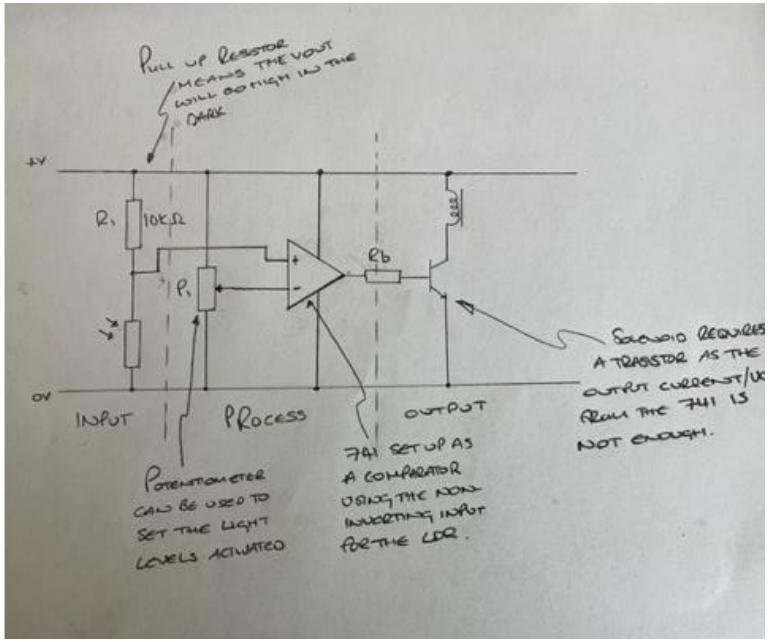
| | | |  <br><br>**Issue 2**<br>Candidates are required to produce an amplified output with or without reversing the direction of the motion.<br><br>To get the correct movement candidates should have calculated that they need a **VR of 1:3**.<br><br>Distance moved by Effort / Distance moved by Load =<br>8mm / 24mm. **(2 marks)**<br><br>Process:<br>Appreciation of the required ratio for their chosen mechanism. i.e. Distance from pivots or number of teeth on driven and driver gear etc.) **(2 marks)** | Award a maximum of 8 marks For Issue 2<br><br>*Candidates who produce the appropriate VR but reverse the output can only access a level 2 response.* | **Level 1 [1-2 marks]**<br>A **limited** demonstration of technical solutions to overcome the issue identified.<br>Limited knowledge and next to no understanding of technical design and technology principles to overcome the issue identified. Solution shows limited development.<br>Response for Issue 1 should be a circuit which has the input/process/output identified and uses mostly correct circuit symbols.<br>Use of information from the RB is used in a simplistic way and adds limited value to the points being made.<br>Sketches if used will be unclear with only basic notes to accompany them.<br>The end to end process may not exist and if anything is basic in nature.<br><br>**Issue 2**<br>**Level 4 [7-8 marks]**<br>A **comprehensive** demonstration of technical solutions to overcome the issue identified.<br>Comprehensive understanding of technical design and technology principles to overcome the issue identified. Solution is well-developed.<br>Issue 2's response should clearly show the magnification of the motion but ensuring that when the solenoid is active |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| | | | Candidate should have clearly shown that the distance from the fulcrum to the effort is 3 times smaller than the distance from the fulcrum to the Load.<br><br>Method of attaching the solenoid and the bolt to the mechanism should be clearly Illustrated. **(2 marks)**<br><br>Candidates have produced a feasible mechanism that will perform the required function. **(2 marks)** | | the output motion is in the correct direction.<br>Information in RB is used effectively to fully exemplify the points being made.<br>Sketches if used will be clear and supported with relevant notes.<br>The process will be end to end and clear in the way it is explained.<br><br>**Level 3 [5-6 marks]**<br>A **good** demonstration of technical solutions to overcome the issue identified.<br>Good understanding of technical design and technology principles to overcome the issue identified. Solution shows a good level of development.<br>Issue 2's response should clearly show the magnification of the motion but ensuring that when the solenoid is active the output motion is in the correct direction, but may lack the detail of fitting to the gate.<br>Information in RB is used for the most part effectively to exemplify points being made although one or two opportunities are missed.<br>Sketches will for the most part be clear and supported with relevant notes.<br>The process will be end to end and for the most part be clear in the way it is explained.<br><br>**Level 2 [3-4 marks]**<br>A **sufficient** demonstration of technical solutions to overcome the issue identified. |

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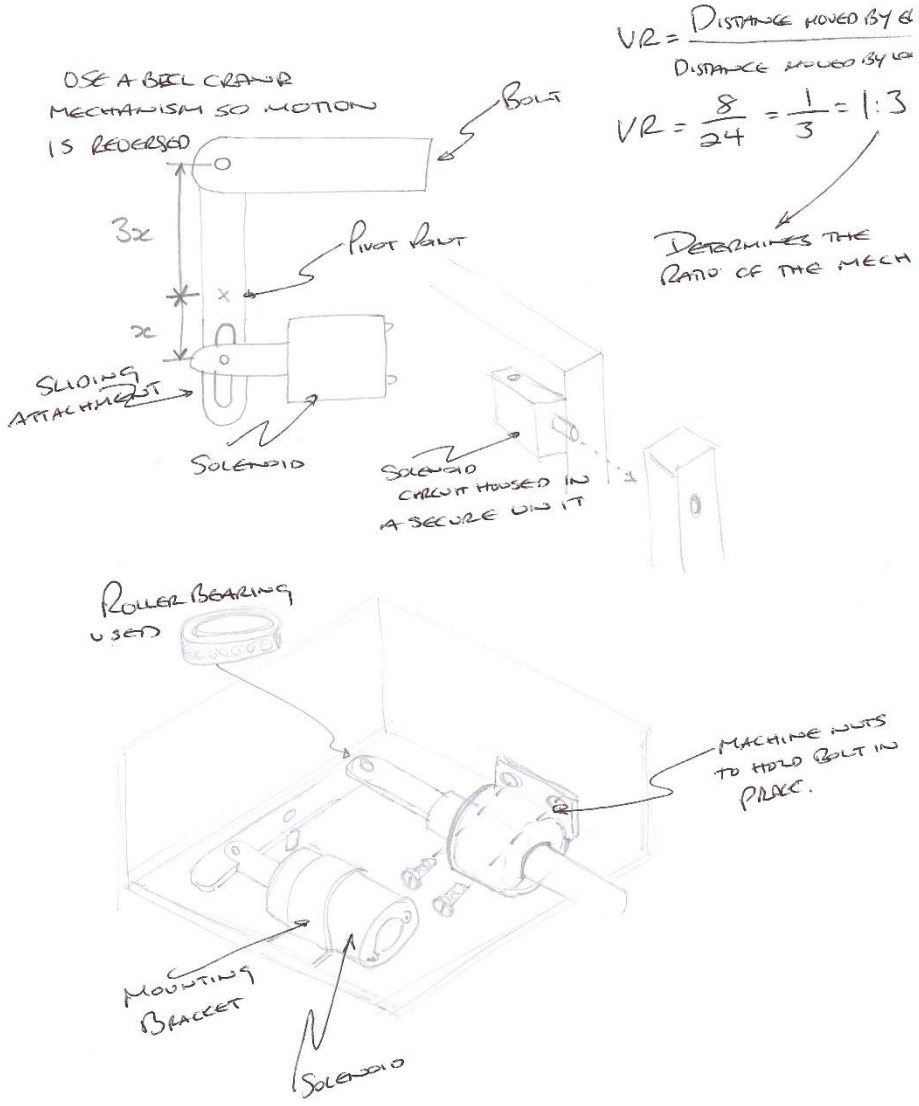
| | | |  | | Sufficient understanding of technical design and technology principles to overcome the issue identified. Solution shows sufficient development but one or two opportunities missed.<br>Issue 2's response should clearly show the magnification of the motion but the output motion has not been reversed and may lack the detail of fitting to the gate.<br>Information in RB is used to exemplify some points being made although much more could have been done to exploit the stimulus material available.<br>Sketches will be adequate and supported with notes.<br>The process may not necessarily be end to end with some knowledge gaps evident.<br><br>**Level 1 [1-2 marks]**<br>A **limited** demonstration of technical solutions to overcome the issue identified.<br>Limited knowledge and next to no understanding of technical design and technology principles to overcome the issue identified. Solution shows limited development.<br>Issue 2's response should clearly show the magnification of the motion but the output motion has not been reversed and may lack the detail of fitting to the gate.<br>Use of information from the RB is used in a simplistic way and adds limited value to the points being made.<br>Sketches if used will be unclear with only basic notes to accompany them. |

| Question | | | Answer | Mark | Guidance |
|---|---|---|---|---|---|
| | | | | | The end to end process may not exist and if anything is basic in nature.<br><br>0 marks = No response or no response worthy of credit. |

| Question | | | Answer | Mark | Guidance |
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| 5* | | | **Indicative content**<br><br>Within their response candidates are expected to discuss the sustainability issues relating to the design, manufacture and maintenance of the outdoor play area. This should include but is not limited to;<br><br>Candidates should refer to positive and negative points in their discussion<br><br>**Recycling Considerations:**<br>• Choosing a material that is sustainable, giving examples of the different schemes used i.e. wood from a sustainably managed forest. Using bamboo, the fastest growing crop in the world which does not require fertilizer.<br>• The use of recycled plastics in the production of parts. The use of examples could be, milk bottles, drinks bottles.<br>• The use of recycled metals in the production of fittings and fasteners.<br>• The use of recycled fabrics for netting or rope.<br>• Processing costs will be increased when using some sustainable materials.<br>• Limited in the processes that can be undertaken with sustainable materials.<br>• Limited on the colours and finishing that can be applied to these materials.<br><br>**Up-cycling Possibilities:**<br>• Acknowledgement that materials can be up-cycled and used for different purposes. Understand the affect this | **16**<br><br>*Any lifted information can be used in support of the critical examination but no marks should be awarded simply for duplicating text.*<br><br>*Candidates should be expected to mention at least two different areas relating to sustainability issues. Where candidates only mention 1 area they* | **Level 4 [13-16 marks]**<br>A **comprehensive** discussion of the issues that would be considered. Considering both positive and negative effects.<br>Comprehensive understanding of a range of issues relating to sustainability. They will have considered all four areas and discussed each in detail, referring to examples learnt within their studies. Specific materials may have been mentioned within their examples.<br>Information in RB is used effectively to fully exemplify the points being made.<br>Well-constructed response in relation to question with a clear and developed narrative.<br><br>*There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*<br><br>**Level 3 [9-12 marks]**<br>A **good** discussion of the issues that would be covered. Will consider both positive and negative effects although may be more weighted on one.<br>Good understanding of a range of issues relating to sustainability. They will have considered at least three areas and discussed each, referring to examples learnt within their studies.<br>Information in RB is used for the most part effectively to exemplify points being made although one or two opportunities are missed.<br>Well-constructed response in relation to question although one or two opportunities not taken to develop narrative. |

| Question | | | Answer | Mark | Guidance |
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| | | | will have on the material and manufacturing costs. i.e. large fallen trees, tyres embedded in the ground to make platforms etc.<br><br>**Material Availability**<br>• Reference could have been made to the availability of materials for the play area. Depending on location and budget will play a role in the type of material that could be used.<br>• Transportation of materials.<br><br>**Cost Implications:**<br>• New materials vs recycled materials.<br>• Cost of recycling materials and implications to product cost and design.<br>• Cost savings of using upcycled materials in their design<br>• Transportation costs that may occur.<br><br>Candidates could also mention about conservation schemes that are used to encourage the use of sustainable materials, with government incentives and conversation areas requiring developers to use these materials. | *are limited to a level 2 response.* | *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.*<br><br>**Level 2 [5-8 marks]**<br>A **sufficient** discussion of the issues that would be considered. Will consider either the positive or negative effects.<br>Sufficient understanding of a range of issues relating to sustainability. They will have considered at least two areas and discussed each, referring to examples learnt within their studies although one or two opportunities will be missed.<br>Information in RB is used to exemplify some points being made although much more could have been done to exploit the stimulus material available.<br>Reasonable response in relation to the question although narrative at times lacks depth and cohesion.<br><br>*The information has some relevance and is presented with limited structure. The information is supported by limited evidence.*<br><br>**Level 1 [1-4 marks]**<br>A **limited** discussions of the issues that would be considered.<br>Limited knowledge and next to no understanding of issues relating to sustainability. They will have considered at least one area in a basic way and made only limited connections with examples learnt within their studies.<br>Use of information from the RB is used in a simplistic way and adds limited value to the points being made.<br>Limited response in relation to question. Narrative is basic and unstructured. |

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| | | | | | *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* |

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