# Cambridge IGCSE™ (9–1)

---

**DESIGN AND TECHNOLOGY (9–1)** **0979/42**

Paper 4 Systems and Control **May/June 2020**

MARK SCHEME

Maximum Mark: 50

---

**Published**

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **8** printed pages.

## Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

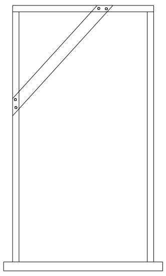
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

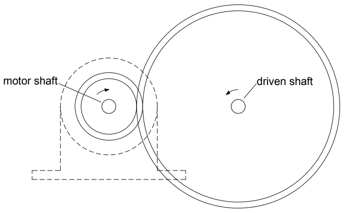
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

## Section A

| Question | Answer | Marks |
|---|---|---|
| 1 | Advantages of plastics could be:<br>• Not affected by wet weather<br>• Will not rot<br>• Self-finishing<br>• Can be moulded / extruded | **2** |

| Question | Answer | Marks |
|---|---|---|
| 2 | <br>Triangulated brace used [1] Suitable size and position [1] Fixing method [1] | **3** |

| Question | Answer | Marks |
|---|---|---|
| 3(a) | Second order lever, 1 mark. | **1** |
| 3(b) | Suitable example, 1 mark. Clear drawing with E/L/F visible, 1 mark | **2** |

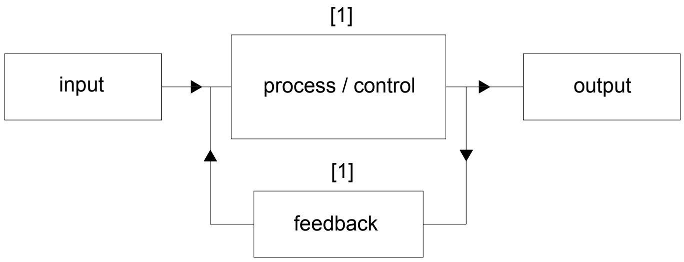
| Question | Answer | Marks |
|---|---|---|
| 4(a) | Reasons could be:<br>• Slipping not acceptable / positive drive<br>• Change in relative speed required<br>• Reduction in part count / no belt or chain required<br>• Low cost of injection moulded gears<br>2 × 1 mark. | **2** |
| 4(b) |  <br>2 gears used, 1 mark. Small gear on motor, large on driven shaft, 1 mark. Gears shown correctly meshed, 1 mark. | **3** |

| Question | Answer | Marks |
|---|---|---|
| 5 | Turning or twisting force, | **1** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6</td><td>
<table>
<tr><th>Material</th><th>Conductor</th><th>Insulator</th></tr>
<tr><td>Tin</td><td>✓</td><td></td></tr>
<tr><td>Mercury</td><td>✓</td><td></td></tr>
<tr><td>Polyvinyl Chloride (PVC)</td><td></td><td>✓</td></tr>
<tr><td>Epoxy resin</td><td></td><td>✓</td></tr>
<tr><td>Aluminium</td><td>✓</td><td></td></tr>
</table>
</td><td><b>4</b></td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 7(a) | Microswitch – safety / cut off switch on machine<br>PTM switch – any use requiring only momentary connection | **2** |
| 7(b) | **PTM** switch **makes contact** when pressed, **PTB** switch **breaks contact** when pressed. | **1** |

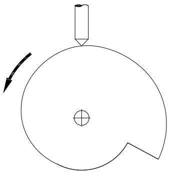
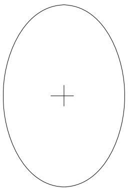
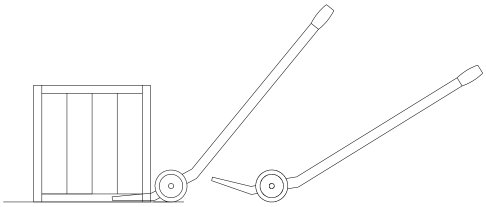
| Question | Answer | Marks |
|---|---|---|
| 8 | Use of aesthetics could be related to:<br>Use of space / colour / texture / form / proportion in the design of casings for electronic devices.<br>2 × 1 mark for any two valid factors. | **2** |

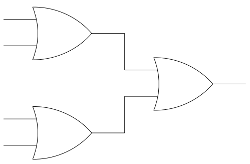
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>9</td><td>


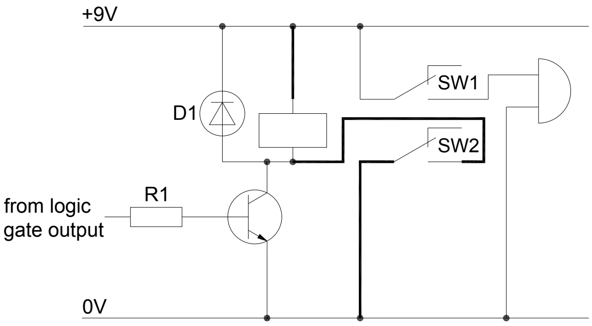
2 × 1 mark.
</td><td><b>2</b></td></tr>
</table>

## Section B

| Question | Answer | Marks |
|---|---|---|
| 10(a)(i) | Notes and sketches to show:<br>• At least 4 pieces laminated, 1 mark<br>• Staggered joints, 1 mark<br>• Length of beam increased, 1 mark. | **3** |
| 10(a)(ii) | Reasons could include:<br>• Large gaps can be spanned<br>• No intrusion into space below<br>• Economical compared to other methods<br>• Laminated beams are extremely stable<br>• Renewable resource used | **1** |
| 10(b)(i) | Shell structure, 1 mark. | **1** |
| 10(b)(ii) | The cross-section shape varies giving rigidity to the moulding, 1 mark<br>There are several curves in the moulding which will increase the resistance to bending, torsion and distorting of the moulding, 1 mark. | **2** |
| 10(c)(i) | Benefits of the single span will include:<br>No obstruction to shipping passing under the bridge<br>• Only two structures to be built in the water<br>• Reduced cost<br>• Aesthetically more pleasing. | **1** |
| 10(c)(ii) | Stationary loads will include:<br>• Materials used, concrete, steel cables, deck, road surface.<br>2 × 1 mark<br><br>Moving loads will include:<br>• Vehicles on the bridge<br>• Wind, snow, rain<br>2 × 1 mark | **4** |
| 10(c)(iii) | Sketches / notes to show rivets or bolts, 1 mark.<br>Steel sheets overlapped, 1 mark. | **2** |
| 10(c)(iv) | Moments at R1 (4.5 × 13000) + (17.5 × 16000) = R2 × 22 [1]<br>58500 + 280000 = R2 × 22, [1]<br>R2 = 338500 / 22 = **15386 N**, [1]<br>R1 = (13000 + 16000) – 15386 = **13614 N**, [1] | **4** |
| 10(c)(v) | Concrete is used as it is very resistant to compression, Reinforcement will increase resistance to torsion, tension and bending. It is also resistant to the effects of bad weather and needs little maintenance. | **2** |
| 10(c)(vi) | Steel is resistant to tension and can readily be drawn out into wire and spun into a cable that is flexible and resistant to stretching. | **2** |
| 10(c)(vii) | Rearrangement of formula force = stress × cross-sectional area, [1]<br>Cross-sectional area = $\pi r^2 = 3.14159 \times 2.5^2 = 19.635$, [1]<br>Force = 1500 × 19.64 = **29452.4 N**, [1] | **3** |

| Question | Answer | Marks |
|---|---|---|
| 11(a)(i) | The driven gear in the hand drill will rotate **faster** than the driving gear and the torque will **decrease**. The driven gear in the crane will rotate **slower** than the driving gear and the torque will **increase**. In both cases the drive will have moved through **90º**.<br>1 mark for each correct. | **5** |
| 11(a)(ii) | Gear ratio = 3.73 : 1 [1]<br>475 / 3.73, [1] = **127.3 rpm** [1] | **3** |
| 11(a)(iii) | Lubrication, 1 mark<br>Covering / protecting the gears to prevent ingress of abrasive substances, 1 mark. | **2** |
| 11(b)(i) | **Rotary** motion to **reciprocating** motion, 1 mark for each. | **2** |
| 11(b)(ii) | <br>1 mark for anticlockwise rotation | **1** |
| 11(b)(iii) | **10 mm** | **1** |
| 11(b)(iv) | <br>Two lifts on cam profile, 1 mark No dwell, 1 mark. | **2** |
| 11(c) | <br>Lever will fit under packing case, 1 mark<br>Handle long enough to decrease effort needed, 1 mark<br>Will provide 100mm lift when rotated, 1 mark | **3** |
| 11(d)(i) | Circumference = 3.14159 × 25 = 78.54<br>MA = 78.54 / 6 = **13.09** | **2** |
| 11(d)(ii) | Total MA = 13.09 × 16 = 209.44, 1 mark<br>209.44 × 20 = **4189 N**, 1 mark | **2** |
| 11(d)(iii) | Loss of efficiency, 1 mark due to friction between male and female thread, 1 mark. | **2** |

| Question | Answer | Marks |
|---|---|---|
| 12(a)(i) | Axes correctly drawn and labelled, 1 mark.<br>Resistance increases as light level decreases, 1 mark. | **2** |
| 12(a)(ii) | The voltage at **X** can be changed by adjusting VR1. | **1** |
| 12(a)(iii) | V out = 243 / (110 + 243) × 9 [1]<br>V out = 0.688 × 9 [1]<br>**V out = 6.195 V** [1] | **3** |
| 12(a)(iv) | Possible reasons could be:<br>Tolerance in the resistors<br>Voltage used not exactly 9 V. | **2** |
| 12(a)(v) | • LDR / VR1 go to the non-inverting input, 1 mark<br>• 2 fixed resistors go to the inverting input, 1 mark<br>• If the voltage at non-inverting input is greater than voltage at inverting input the output will be close to 9 V.<br>• If the voltage at inverting input is greater than voltage at non-inverting input the output will be close to 0 V<br>1 mark for each correct statement either written or illustrated, 3 × 1 mark. | **3** |
| 12(b)(i) | When the door is closed the magnet **A** will hold the contacts of the switch together, [1] output voltage will be 0 V, [1]<br>When the door is open the switch contacts are open, [1]<br>Output is 9 V through the 10 kΩ resistor, [1]<br>3 × 1 mark from any three points. | **3** |
| 12(b)(ii) | <br>OR gates used, 1 mark<br>Correctly connected, 1 mark. | **2** |
| 12(b)(iii) | R1 is a current limiting resistor for the base of the transistor, 1 mark.<br><br>D1 is there to prevent back emf from damaging the transistor, 1 mark. | **2** |
| 12(b)(iv) | • When the relay operates both switches close. [1]<br>• One switch operates the bell / sounder [1]<br>• The other switch provides a 0 V connection for the relay coil. [1]<br>• When the sensor becomes inactive the 0 V connection is still provided for the relay coil through the switch. [1] | **3** |

| Question | Answer | Marks |
|---|---|---|
| 12(b)(v) |  <br>Circle anywhere on heavy lines, 1 mark. | 1 |
| 12(b)(vi) | **Capacitor**, 1 mark **Resistor**, 1 mark | 2 |
| 12(b)(vii) | **PIC**, 1 mark | 1 |