This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners’ meeting before marking began, which would have considered the acceptability of alternative answers.

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

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2010 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.
Mark Scheme Notes

Marks are of the following three types:

M  Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A  Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B  Mark for a correct result or statement independent of method marks.

• When a part of a question has two or more “method” steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.

• The symbol √ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously “correct” answers or results obtained from incorrect working.

• Note:  B2 or A2 means that the candidate can earn 2 or 0.
  B2/1/0 means that the candidate can earn anything from 0 to 2.

The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored.

• Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.

• For a numerical answer, allow the A or B mark if a value is obtained which is correct to 3 s.f., or which would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated above, an A or B mark is not given if a correct numerical answer arises fortuitously from incorrect working. For Mechanics questions, allow A or B marks for correct answers which arise from taking $g$ equal to 9.8 or 9.81 instead of 10.
The following abbreviations may be used in a mark scheme or used on the scripts:

AEF      Any Equivalent Form (of answer is equally acceptable)
AG       Answer Given on the question paper (so extra checking is needed to ensure that
         the detailed working leading to the result is valid)
BOD      Benefit of Doubt (allowed when the validity of a solution may not be absolutely
         clear)
CAO      Correct Answer Only (emphasising that no “follow through” from a previous error
         is allowed)
CWO      Correct Working Only – often written by a ‘fortuitous’ answer
ISW      Ignore Subsequent Working
MR       Misread
PA       Premature Approximation (resulting in basically correct work that is insufficiently
         accurate)
SOS      See Other Solution (the candidate makes a better attempt at the same question)
SR       Special Ruling (detailing the mark to be given for a specific wrong solution, or a
         case where some standard marking practice is to be varied in the light of a
         particular circumstance)

Penalties

MR –1    A penalty of MR –1 is deducted from A or B marks when the data of a question or
         part question are genuinely misread and the object and difficulty of the question
         remain unaltered. In this case all A and B marks then become “follow through √”
         marks. MR is not applied when the candidate misreads his own figures – this is
         regarded as an error in accuracy. An MR –2 penalty may be applied in particular
         cases if agreed at the coordination meeting.

PA –1    This is deducted from A or B marks in the case of premature approximation. The
         PA –1 penalty is usually discussed at the meeting.
<table>
<thead>
<tr>
<th>Question</th>
<th>Mark Scheme</th>
<th>Syllabus</th>
<th>Paper</th>
</tr>
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<tbody>
<tr>
<td>1 (i)</td>
<td>M1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For using (-g = (0 - V)/(2 - 0))\ or (0 = V - gt)</td>
<td></td>
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<tr>
<td></td>
<td>(V = 20)</td>
<td>A1 [2]</td>
<td></td>
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<tr>
<td>(ii)</td>
<td>Speed is 40 ms(^{-1})</td>
<td>B1 [1]</td>
<td></td>
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<tr>
<td>(iii)</td>
<td>M1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>For using (h = \frac{1}{2} 4 \times 40)\ or (h = \frac{1}{2}g \times 4^2) or (40^2 = 2gh)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Height is 80 m</td>
<td>A1 [2]</td>
<td></td>
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<tr>
<td>2</td>
<td>M1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>For using Newton’s second law (3 terms)</td>
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<td></td>
<td>(F_A - 800 = 600a_A)</td>
<td>A1</td>
<td></td>
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<tr>
<td></td>
<td>(F_A = 40000/25 (1600))</td>
<td>B1</td>
<td></td>
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<tr>
<td></td>
<td>(40000/v_B - 800 = 600 (400/600))</td>
<td>A1</td>
<td></td>
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<tr>
<td></td>
<td>Speed is 33.3 ms(^{-1})</td>
<td>A1 [5]</td>
<td></td>
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<tr>
<td>3</td>
<td>M1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>For triangle of forces \ or for resolving in dir° XP(_1), \ or for using Lami’s theorem \ or for resolving forces at X \ vertically and horizontally \ (equations must contain not more than one unknown angle)</td>
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<td></td>
<td>For correct (\Delta) or resolve XP(_1) \ and (\cos \alpha = 5.5/7.3); \ or (5.5/\sin(90° + \alpha) = 7.3/\sin90°) (Lami); \ or (5.5\cos \alpha + W\sin \alpha = 7.3) \ and (5.5\sin \alpha = W\cos \alpha).</td>
<td>A1</td>
<td></td>
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<tr>
<td></td>
<td>Angle AP(_1)X = 41.1° or 0.718°</td>
<td>A1</td>
<td></td>
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<tr>
<td></td>
<td>For correct triangle and (W^2 = 7.3^2 - 5.5^2); \ or (W/\sin(180° - 41.1°) = 7.3/\sin90°); \ or (W\sin41.1° = 7.3 - 5.5\cos41.1°) \ or (W\cos41.1° = 5.5\sin41.1°)</td>
<td>A1 ft ft incorrect (\alpha)</td>
<td></td>
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<td></td>
<td>(W = 4.8)</td>
<td>A1 [5]</td>
<td></td>
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<tr>
<td>4 (i)</td>
<td>B1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>For using ((u + v)/2 = s/t)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Displacement is 25 m</td>
<td>B1 [2]</td>
<td></td>
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<tr>
<td>(ii)</td>
<td>M1</td>
<td></td>
<td></td>
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<td></td>
<td>For using (v = \int adt)</td>
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<tr>
<td></td>
<td>(v = 0.015t^2 (+ C))</td>
<td>A1</td>
<td></td>
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<tr>
<td></td>
<td>([3.5 = 0.015 \times 100 + C \rightarrow C = 2])</td>
<td>B1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>([s = 0.005t^3 + 2t + (0)])</td>
<td>M1 [5]</td>
<td></td>
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<tr>
<td></td>
<td>Displacement is 25 m, same as P.</td>
<td>A1</td>
<td></td>
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</table>
5 (i) \[v^2 = 3^2 + 2 \times 2.5 \times 8\] M1 For using \(v^2 = u^2 + 2as\)
   Speed is 7 ms\(^{-1}\) A1 [2]

(ii) KE gain = \(\frac{1}{2} 0.8(7^2 - 3^2) (= 16)\) B1ft ft incorrect speed
   PE loss = 16 + 7 B1ft ft incorrect expression for KE
   \([0.8 \times 10 \times 8 \sin\alpha = 23]\) M1 For using PE loss = \(mgL\sin\alpha\)
   Angle is 21.1° or 0.368\(^\circ\) A1 [4]

(ii) ALTERNATIVELY
   \(F = 7/8\) B1
   \([0.8 \times 10\sin\alpha - F = 0.8 \times 2.5]\) M1 For using Newton’s second law
   
   \(0.8 \times 10\sin\alpha - 0.875 = 0.8 \times 2.5\) A1
   Angle is 21.1° or 0.368\(^\circ\) A1

(iii) \(5^2 = 3^2 + 2 \times 2.5s (s = 3.2)\) B1
   \([WD/7 = 3.2/8\)
   or WD = 0.875 \times 3.2
   or WD = 8 \times 3.2 \times (23/64)
   \(- \frac{1}{2} 0.8(5^2 - 3^2)\)]
   Work done is 2.8 J A1 [3]

6 (i) (a) PE loss = 0.2g(3 – h) B1
   \([0.2g(3 – h) = 1.6]\) M1 For using PE loss = KE gain
   \(h = 2.2\) A1 [3]

(b) KE is 6 J B1 [1]

(c) \(\left[\frac{v_G}{v_B} = (3/(3 - 2.2))^{\frac{1}{2}}\right]\)
   or \(v_G / v_B = \sqrt{6}/1.6\) M1 For using \(v^2 \propto (3 – ht)\)
   \(\text{or } (v_G / v_B)^2 = \text{Ans. (i)(b)} ÷ 1.6\)
   Ratio is 1.94 A1 [2] Accept \(\sqrt{60} ÷ 4 \text{ or } \sqrt{15} ÷ 2\)

(ii) M1 For using \(v^2 \propto (H – ht)\)
   or using \(\frac{1}{2} m(2.55v_B)^2 = mgH\)
   and \(\frac{1}{2} mv_B^2 = mg(H – 2.2)\) and eliminating \(v_B^2\)
   \(H/(H – 2.2) = 2.55^2\) A1
   \(H = 2.6\) A1 [3]
7 (i) M1 For resolving forces on Q vertically
   \[ R + 3.2\sin30^\circ = 0.5g \] A1
   M1 For resolving forces on Q horizontally and using \[ T = W_p \]
   \[ F + 0.2g = 3.2\cos30^\circ \] A1
   \[ \left[ \mu = \frac{(3.2\cos30^\circ - 2)}{(5 - 3.2\sin30^\circ)} \right] \] M1 For using \[ F = \mu R \]
   Coefficient is 0.227 A1 [6]

(ii) B1
   \[ 2 - T = 0.2a \]
   \[ T - 0.227 \times 5 = 0.5a \] B1
   Allow B1ft for \[ 2 - 0.227 \times 5 = (0.2 + 0.5)a \] instead of one of the above equations
   \[ 2 - 0.227 \times 5 = (0.2 + 0.5)a \] M1 For solving for \( a \) or \( T \)
   Acceleration is 1.24 m/s\(^2\) and tension is 1.75 N A1 Allow \( a = 1.25 \) [4]