| **Question** | **Scheme** | | **Marks** |
| --- | --- | --- | --- |
| **1** |  | |  |
|  | | B1 |
|  | | M1 |
| =78*g* | | A1 |
|  | |  |
| *P* | 2.5 × 18*g* cos *α* + 3 × 60*g* cos *α* = 5F sin *α* | | M1 A1 A1 |
| *A* | 18*g* × 2.5 cos *α* + 60*g* × 3 cos *α* = *R* × 5 sin *α* | |  |
| *C* | ½ cos *α* × 18*g +* 3 sin *α F* + 2 sin *α R* = 3 cos *α N* | |  |
| *B* | 5 cos *α N* = 5 sin *α F* + 2.5 cos *α* × 18*g* + 2 cos *α* × 60*g* | |  |
| *W* | 60*g* × ½ cos *α +* 2.5*N* cos *α* = 2.5*R* sin *α* + 2.5*F* sin *α* | |  |
|  |  | | DM1 |
|  | |  |
|  | | M1 |
|  | | A1 |
|  |  | | **(9 marks)** |
| **2(a)** | *M*(*A*), *F*  4 sin 40° = 5*g* 2cos 25° | A complete method to fond *F*, e.g. take moments about *A*.  Condone sin/cos confusion. Requires correct ratio of lengths. | M1 |
| Correct terms with at most one slip | A1 |
| All correct | A1 |
| *F* = 35 | 35 or 34.5 (>3sf not acceptable due to use of 9.8, but only penalise once in a question | A1 |
|  |  | | **(4)** |
| **2(b)** | *F* cos 75° ± *Y* = 5*g* | Resolve vertically. Need all three terms but condone sign errors. Must be attempting to work with their 75° or 15°. | M1 |
| Correct equation (their *F*) | A1 |
| *Y* = 40 | 40 or 40.1  Apply ISW if the candidate goes on to find *R*. | A1 |
| UP | Cso (the Q does specifically ask for the direction, so must be clearly stated) | A1 |
|  |  | | **(4)** |
|  |  | | **(8 marks)** |
| **3** |  | |  |
| Resolve horizontally or vertically: | | M1 |
| or | | A1 |
| Take moments about *A* or *B.* | | M1 |
| *M*(*A*):  *M*(*B*): | | A2 |
| or | | M1 |
|  | | dM1 |
|  | | dM1 |
|  | | A1 |
|  |  | | **(9 marks)** |
| **4** |  | | M1 A1 |
|  | | **(2)** |
|  | | M1 |
| 3 independent equations required. Award M1A1 for each in the order seen. If more than 3 relevant equations seen, award the marks for the best 3. | | |
|  | | M1 A1 |
|  | | M1 A1 |
|  | | M1 A1 |
| M(C) | |  |
| Parallel: | |  |
| Perpendicular: | |  |
|  | | DM1  A1 |
| Reactions in the wrong direction(s) – check carefully | |  |
|  |  | | **(9)** |
|  |  | | **(11 marks)** |
| **5(a)** | V  H | |  |
| Moments about A: | | M1 |
|  | | A2 |
| **\*Answer given\*** | | A1 |
|  |  | | **(4)** |
| **5(b)** |  | | M1  A1 |
|  | | M1  A1 |
|  | | A1 |
|  |  | | **(5)** |
| **5(c)** |  | | M1  A1 |
| , | | DM1  A1 |
|  |  | | **(4)** |
|  |  | | **(13 marks)** |
| **6(a)** | Taking moments about A: | | M1 |
|  | | A1 A1 |
| *T* = 18.4 N | | A1 |
|  |  | | **(4)** |
| **6(b)** | ↑ | |  |
|  | | M1 A1 |
| → | | M1 A1 |
|  | | M1 A1 |
|  | | A1 |
|  |  | | **(7)** |
|  |  | | **(11 marks)** |
| **7(a)** | Resolving vertically: | | M1 |
|  | | A1 |
| Moments about *A*: | | M1 |
|  | | A1 |
| **\*\*** | | DM1 |
| A1 |
|  |  | | **(6)** |
| **7(b)** | NB  with correct conclusion is possible | |  |
|  | | B1 |
|  | | M1 |
| = | | DM1 |
| A1 |
| Resultant at *A* =  (0.79*W*) | | DM1 |
| A1 |
|  |  | | **(6)** |
|  |  | | **(12 marks)** |
| **8** |  | |  |
| Taking moments about A: | |  |
|  | | M1 A1 |
| Resolving vertically: | |  |
|  | | M1 A1 |
| Resolving horizontally: | |  |
|  | | M1 A1 |
| (Most alternative methods need 3 independent equations, each one worth M1A1. Can be done in 2 e.g. if they resolve horizontally and take moments about *X* then  scores M2A2) | |  |
| Substitute trig values to obtain correct values for F and R (exact or decimal equivalent). | | DM1 |
| ,  , | | A1 |
| . | | M1 |
|  | | A1 |
|  |  | | **(10 marks)** |
| **9(a)** |  | |  |
|  | | M1 A2,1,0 |
|  | |  |
|  | |  |
|  | | M1 |
|  | |  |
| **\*\*** | | A1 |
|  |  | | **(5)** |
| **9(b)** |  | | M1 |
|  | | A1 |
| **\*\*** | | A1 |
|  |  | | **(3)** |
| **9(c)** |  | | M1 A2,1,0 |
|  | |  |
|  | | DM1 A1 |
|  |  | | **(5)** |
|  |  | | **(13 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | M2 Jan 2013 | 3 |  | Statics of rigid bodies | 1.1b, 1.2, 3.1b |
| 2 | M2 2012 | 3 |  | Statics of rigid bodies | 1.1b, 2.1, 2.2a, 3.1b |
| 3 | M2 2015 | 4 |  | Statics of rigid bodies | 1.1b, 2.1, 3.1b, 3.3 |
| 4 | M2 2013R | 4 |  | Statics of rigid bodies | 1.1b, 2.1, 3.1b, 3.4 |
| 5 | M2 2013 | 5 |  | Statics of rigid bodies | 1.1b, 2.1, 2.2a, 3.1b |
| 6 | M2 Jan 2012 | 5 |  | Statics of rigid bodies | 1.1b, 1.2, 2.2a, 3.1b |
| 7 | M2 2014 | 7 |  | Statics of rigid bodies | 1.1b, 2.1, 2.2a, 3.1b |
| 8 | M2 Jan 2011 | 7 |  | Statics of rigid bodies | 1.1b, 1.2, 2.1, 2.2a, 2.5, 3.1b |
| 9 | M2 2011 | 7 |  | Statics of rigid bodies | 1.1b, 1.2, 2.2a, 3.1b |