| **Question** | **Scheme** | **Marks** |
| --- | --- | --- |
| **1(a)** |  | M1 A1  A1 |
|  |  | **(3)** |
| **1(b)** |  | M1  A1 |
|  |  | **(2)** |
| **1(c)** |  | M1 A2  A1 |
|  |  | **(4)** |
|  |  | **(9 marks)** |
| **2(a)** | *A P G Q C B*  (0.2*S*) *R* 75g 30g 75g (*S*) 5*R* |  |
|  | M1 A2 |
|  | M1 A2  A1 |
| (N.B. Or another Moments Equation) | **(**M1 A2) |
|  |  | **(7)** |
| **2(b)** | uniform – mass is or acts at midpoint of plank; centre of mass is at middle of plank; weight acts at the middle of the plank, centre of gravity is at midpoint  rod - plank does not bend, remains straight, is inflexible, is rigid | B1B1 |
|  |  | **(2)** |
|  |  | **(9 marks)** |
| **3(a)** | 3 m  2 m  1 m  *C*  *B*  *A* |  |
| Taking moments about B: 5 x R*C* = 20g x 3 | M1A1 |
| RC = 12g or 60g/5 or 118 or 120 | A1 |
|  |  |
| Resolving vertically: | M1 |
|  | A1 |
|  |  | **(5)** |
| **3(b)** | 3 m  2 m  20g  1 m  *C*  *B*  *A*  30g  *x* |  |
|  | Resolving vertically: 50g = R + R | B1 |
|  | Taking moments about B: |  |
|  |  | M1 A1 A1 |
|  |  |  |
|  | *x* = 3.8 or better or 23/6 oe | A1 |
|  |  | **(5)** |
|  |  | **(10 marks)** |
| **4(a)** | Resolving vertically: | M1A1 |
| Moments about *A*: | M1A1 |
| Substitute and solve: | **DM1** |
|  | A1 |
|  |  | **(6)** |
| **4(b)** | Resolving vertically: | M1A1 **ft** |
| Moments about A: | M1A1 **ft** |
| Substitute and solve: | **DM1** |
|  |  |
| , | A1 |
|  |  | **(6)** |
|  |  | **(12 marks)** |
| **5(a)** |  |  |
|  | M1 A1 |
| 🞸 | DM1 A1 |
|  |  | **(4)** |
| **5(b)** |  |  |
|  | M1 A2(1, 0) |
| Leading to | DM1 A1 |
|  |  | **(5)** |
|  |  | **(9 marks)** |
| **6(a)** | X  X  *P*  *R*  *Q*  40g  20g  Mg  2 m  2 m  2 m  2 m |  |
| **EITHER** M(*R*), 8*X* + 2*X* = 40g x 6 + 20g x 4 | M1 A2 |
| solving for *X*, *X* = 32g = 314 or 310 N | M1 A1 |
| *X* + *X* = 40g + 20g + *M*g (or another moments equation) | M1 A2 |
| solving for *M*, *M* = 4 | M1 A1 |
|  |  |
| **OR** M(*P*), 6*X* = 40g x 2 + 20g x 4 + *M*g x 8 | M1 A2 |
| solving for *X*, *X* = 32g = 314 or 310 N | M1 A1 |
| *X* + *X* = 40g + 20g + *M*g (or another moments equation) | M1 A2 |
| solving for *M*, *M* = 4 | M1 A1 |
|  |  | **(10)** |
| **6(b)** | Masses concentrated at a point or weights act at a point | B1 |
|  |  | **(1)** |
|  |  | **(11 marks)** |
| **7(a)** |  | M1 A1  M1 A1  A1 A1 |
|  |  | **(6)** |
| **7(b)** |  | M1 A1 |
|  | A1 |
|  | M1 A1  B1 |
|  |  | **(6)** |
|  |  | **(12 marks)** |
| **8** | *d* m  *A* 0.5m *S G T* 2m *B*      30 g |  |
|  |  | M1 A1  M1 A1  **DM1** A1  A1 |
|  |  | **(7 marks)** |
| **9(a)** | Resolving vertically: | M1A1 |
| Moments about B: | M1A1 |
| Substitute and solve for d : | **D**M1 |
| (m) | A1 |
|  |  | **(6)** |
| **9(b)** | Moments about C: | M1A1 |
| or equivalent | A1 |
|  |  | **(3)** |
| **9(c)** | solving *TB* ≥ 0 or *TB* > 0 for *k*.  0 < *k* ≤ 2/3 or 0 < *k* < 2/3 only | M1  A1 |
|  |  | **(2)** |
|  |  | **(11 marks)** |
| **10(a)** |  |  |
| Vertical equilibrium:, | M1A1 |
| Moments about *C*: | M1A1 |
| , | **DM1**A1 |
|  |  | **(6)** |
| **10(b)** |  |  |
| *S*, 4*S* | B1 |
| Vertical equilibrium: | M1A1 |
| Moments about *B*: | M1A1 |
|  | **DM1** |
| *m* = 400/17, 24, 23.5 or better | A1 |
|  |  | **(7)** |
|  |  | **(13 marks)** |
| **11(a)** |  |  |
| M(*P*), | M1 A1 |
| M(*Q*), | M1 A1 |
|  |  |
|  | **DM**1 A1 |
|  | **DM**1 A1 |
|  |  | **(8)** |
| **11(b)** |  |  |
|  | M1 A1 **ft** |
|  | M1 A1 **ft** |
|  | **DM**1 A1 |
|  |  | **(6)** |
|  |  | **(14 marks)** |
| **12(a)** | M(*A*): | M1 |
| A1 |
| Resolving horizontally: | B1 |
| Resolving vertically: | M1 |
| A1 |
| DM1 |
|  | A1 |
|  | A1 |
|  |  | **(8)** |
| **12(b)** |  | M1 |
|  | A1 |
|  | M1 |
|  | A1 |
|  |  | **(4)** |
|  |  | **(12 marks)** |
| **13(a)** |  |  |
| seen or implied | B1 |
| M(*C*): | M1 |
| A1 |
| A1 |
|  |  |
|  | dM1 |
| (N) | A1 |
|  |  | **(6)** |
| **13(b)** | Resolve : | M1 |
| A1 |
| Resolve : | M1 |
| A1 |
| Solve simultaneous equations for |  |
| , | A1 |
|  |  | **(5)** |
|  |  | **(11 marks)** |
| **14(a)** |  |  |
|  | B1 |
|  | B1 |
|  | B1 |
| , | M1 |
| A1 |
|  |  | **(5)** |
| **14(b)** | M (*B*)  M (c of m) | M1 |
| A2 |
|  | DM1 |
|  |  |
|  | A1 |
|  |  | **(5)** |
|  |  | **(10 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | M1 Jan 2013 | 2 |  | Moments | 1.1b, 2.2a, 3.1b |
| 2 | M1 2017 | 3 |  | Moments | 1.1b, 2.4, 3.4 |
| 3 | M1 Jan 2011 | 3 |  | Moments | 1.1b, 3.1b |
| 4 | M1 2014 | 4 |  | Moments | 1.1b, 3.1b, 3.3 |
| 5 | M1 Jan 2012 | 4 |  | Moments | 1.1b, 3.1b |
| 6 | M1 2011 | 5 |  | Moments | 1.1b, 2.2a, 2.4, 3.1b |
| 7 | M1 2015 | 5 |  | Moments | 1.1b, 2.1, 3.1b, 3.3, 3.4 |
| 8 | M1 2016 | 6 |  | Moments | 1.1b, 2.1, 3.1b |
| 9 | M1 2014R | 6 |  | Moments | 1.1b, 2.1, 2.5, 3.1b |
| 10 | M1 2013R | 8 |  | Moments | 1.1b, 3.1b |
| 11 | M1 2013 | 6 |  | Moments | 1.1b, 2.1, 3.1b |
| 12 | M2 2016 | 5 |  | Equilibrium and moments | 1.1b, 2.1, 2.2a, 3.1b |
| 13 | M2 2017 | 5 |  | Moments and equilibrium | 1.1b, 2.1, 2.2a, 3.3 |
| 14 | M2 2014R | 3 |  | Moment of a force, equilibrium of a rigid body | 1.1b, 2.1, 2.2a, 3.1b |