| **Question** | **Scheme** | **Marks** |
| --- | --- | --- |
| **1(a)** |  | M1 A1  A1 |
|  |  | **(3)** |
| **1(b)** |  | M1 A1  A1 |
|  |  | **(3)** |
|  |  | **(6 marks)** |
| **2(a)** | *\_*  *w*  *\_*  *v*  \_  6  m  \_  s  \_  -  1  \_  5  m  \_  s  \_  -  1  *B*  3  *A*  2 |  |
|  | M1A1 |
|  | A1 |
|  |  | **(3)** |
| **2(b)** |  | M1A1 |
|  | A1 |
|  |  | **(3)** |
|  |  | **(6 marks)** |
| **3(a)** | For *P*, | M1 A1 |
|  | A1 |
|  |  | **(3)** |
| **3(b)** | For *Q*, | M1 A1 |
|  | A1 |
| **OR** |  |
|  | M1 A1 |
|  | A1 |
|  |  | **(3)** |
|  |  | **(6 marks)** |
| **4(a)** |  |  |
| For *Q*  *I* = 3000 × 9 = 27000 (N s) | M1A1 |
|  |  | **(2)** |
| **4(b)** | Conservation of linear momentum leading to |  |
| 15*m* = – 3*m* + 3000 × 9 | M1 A1 |
| *m* = 1500 | A1 |
|  |  | **(3)** |
|  |  | **(5 marks)** |
| **5(a)** | Conservation of momentum: |  |
|  | M1 A1 |
|  | A1 |
|  |  | **(3)** |
| **5(b)** | Impulse = change in momentum |  |
|  | M1 A1 |
|  |  | **(2)** |
|  |  | **(5 marks)** |
| **6(a)** | 3  2  *v* |  |
| CLM: 3x3 - 2x2= 3*v* + 2(*v*+1) | M1 A1 |
| *vP*= 0.6 m s-1; *vQ*= 1.6 m s-1 | M1A1  (A1 **ft)** |
|  |  | **(5)** |
| **6(b)** |  | M1 A1 **ft** |
|  | A1 |
|  |  | **(3)** |
|  |  | **(8 marks)** |
| **7(a)** | 4*u* 3*u*    *P* (2*m*) *Q* (3*m*)  *V* *u* | M1 A1  A1 |
|  |  | **(3)** |
| **7(b)** | (Has been) reversed | B1 |
|  |  | **(1)** |
| **7(c)** |  | M1 A1  A1  **OR**  M1 A1  A1 |
|  |  | **(3)** |
|  |  | **(7 marks)** |
| **8** |  | M1 |
|  | M1 A1 |
|  | M1 A1 |
|  | M1 A1 |
|  |  | **(7 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | M1 2015 | 1 | 1.1 | Momentum and impulse | 1.1b, 3.1b |
| 2 | M1 2013R | 1 | 1.1 | Momentum and impulse | 1.1b, 3.1b |
| 3 | M1 2013 | 1 | 1.1 | Momentum and impulse | 1.1b, 3.1b |
| 4 | M1 Jan 2012 | 1 | 1.1 | Momentum and impulse | 1.1b ,3.1b |
| 5 | M1 Jan 2011 | 1 | 1.1 | Momentum and impulse | 1.1b, 3.1b |
| 6 | M1 2011 | 2 | 1.1 | Momentum and impulse | 1.1b, 3.1b |
| 7 | M1 2017 | 2 | 1.1 | Momentum and impulse | 1.1b, 2.2a, 3.1b |
| 8 | M1 2016 | 3 | 1.1 | Momentum and impulse | 1.1b, 2.2a, 3.1b |