| **Question** | **Scheme** | **Marks** |
| --- | --- | --- |
| **1(a)** | Max friction | B1 |
| Work done against friction | M1 |
| Equation in : , | dM1 |
| A1 |
| or 0.42 | A1 |
|  |  | **(5)** |
| **1(b)** | or equivalent | M1 |
| A2 |
| (5.9) (m s-1) | A1 |
|  |  | **(4)** |
|  |  | **(9 marks)** |
| **2(a)** | PE lost  J | M1 |
| A1 |
|  |  | **(2)** |
| **2(b)** |  | M1 |
| A2 |
| N | A1 |
|  | B1 |
|  | M1 |
| A1 |
|  |  | **(7)** |
| **2(c)** |  | M1 |
| A1 |
|  | DM1 |
|  | A1 |
|  |  | **(4)** |
|  |  | **(9 marks)** |
| **3(a)** | *B*  *A*  *u* |  |
|  | M1 A1 |
|  |  |
|  | DM1 A1 |
|  |  | **(4)** |
| **3(b)** |  | B1 |
|  | M1 |
| Work done by friction |  |
|  | M1 A1 A1 |
|  |  |
|  | A1 |
|  |  | **(6)** |
|  |  | **(10 marks)** |
| **4(a)** |  |  |
|  | M1 |
|  | B1 |
| Work done | M1 A1 |
|  |  | **(4)** |
| **4(b)** |  | M1 A1 A1 |
|  | A1 |
|  |  | **(4)** |
| **4(c)** |  |  |
|  | M1 |
|  | A1 |
|  |  |
|  |  |
| Speed = 5.0 m s-1 | A1 |
|  |  | **(4)** |
|  |  | **(11 marks)** |
| **5(a)** |  | B1 |
|  | M1 A1 A1 |
|  | A1 |
|  |  | **(5)** |
| **5(b)** |  | M1 A1 ft  A1 ft |
|  | A1 |
|  |  | **(4)** |
| **5(c)** |  | M1 A1 A1 |
|  | DM1 A1 |
|  |  | **(5)** |
|  |  | **(14 marks)** |
| **6(a)** |  |  |
| Impact with wall: | B1 |
| Impulse | M1 |
| Magnitude 32*mu* (Ns) | A1 |
|  |  | **(3)** |
| **6(b)** | CLM: | M1 |
| A1ft |
| Impact: | M1 |
| A1ft |
|  |  |
|  | DM1 |
| Use of  in their *w*: | M1 |
| Hence  and *A* and *B* are moving in the same direction | A1 |
|  |  | **(7)** |
| **6(c)** | KE of *B* before collision | B1 |
|  | M1 |
| , | A1 |
|  | A1 |
|  |  | **(4)** |
|  |  | **(14 marks)** |
| **7(a)** | Work done against friction = Loss in GPE– Gain in KE  = | M1 |
| A2 |
| = 85 (J) (84.6) | A1 |
|  |  | **(4)** |
| **7(b)** |  | M1 |
| A1 |
| Work done = 10*F* = | M1 |
| A1ft |
|  | A1 |
|  |  | **(5)** |
|  |  | **(9 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | M2 2015 | 5 | 2.1 | Work and energy | 1.1b, 3.1b, 3.4 |
| 2 | M2 2014R | 5 | 2.1 | Work and energy | 1.1b, 2.1, 2.2a, 3.1b, 3.4 |
| 3 | M2 2011 | 5 | 2.1 | Work and energy | 1.1b, 3,1b, 3.4 |
| 4 | M2 Jan 2013 | 5 | 2.1 | Work and energy | 1.1b, 2.2a, 3.1b, 3.4 |
| 5 | M2 2012 | 6 | 2.1 | Work and energy, Power | 1.1b, 2.1, 2.2a, 3.1b, 3.4 |
| 6 | M2 2017 | 7 | 2.1 | Successive impacts and kinetic energy | 1.1b, 2.1, 3.1b, 3.2a, 3.4 |
| 7 | M2 2014 | 8 | 2.1 | Kinematics of a particle moving in a straight line or plane,  Work and energy | 1.1b, 2.1, 2.2a, 3.1b |