| **Question** | **Scheme** | **Marks** |
| --- | --- | --- |
| **1(a)** |  | B1 |
| Use of  | B1 |
|  | M1A1 |
|   (m s-2) or 2.5 (m s-2)  | A1 |
|  |  | **(5)** |
| **1(b)** |  Speed at *B* is 3.9 (m s-1) or 3.91(m s-1) | M1A1 |
|  |  | **(2)** |
|  |  | **(7 marks)** |
| **2** |  | M1 A1M1 A1M1 A1B1 |
|  |  | M1A1 |
|  |  | **(9 marks)** |
| **3(a)** |  | M1 |
|   | A1 |
|  |  | **(2)** |
| **3(b)** |   | M1 A1 |
|   | A1 |
|  |  | DM1 A1ft |
|  |  | **(5)** |
| **3(c)** |  | M1 |
|   | A1 |
| Parallel to  | M1 |
|   | A1 |
|  |  | **(4)** |
|  |  | **(11 marks)** |
| **4(a)** |  Use of  | M1 |
|   | A1 |
|  Deceleration is 1.02(m s-2) | A1 |
|  |  | **(3)** |
| **4(b)** | Horizontal forces on the car:  | M1A2 **f.t.** |
|  *T* = –1550/3  |  |
|  The force in the tow-bar is 1550/3, 520 (N) or better (allow –ve answer) | A1 |
|  |  | **(4)** |
| **4(c)** | Horizontal forces on the truck:  | M1A2 **f.t.** |
|  Braking force *R* = 1750 (N) | A1 |
|  |  | **(4)** |
|  |  | **(11 marks)** |
| **5(a)** |  |  |
| Perpendicular to the slope:  | M1A2 |
|  = 31.8 (N) or 32 (N) | A1 |
|  |  | **(4)** |
| **5(b)** | Parallel to the slope:  | M1A2 |
|  Use of  | M1 |
|   | A1 |
|  |  | **(5)** |
| **5(c)** | Component of wt parallel to slope =  | B1 |
|  (N) | M1A1 |
| so the particle moves | A1 |
|  |  | **(4)** |
|  |  | **(13 marks)** |
| **6(a)** | Inextensible string | B1 |
|  |  | **(1)** |
| **6(b)** | 4*mg* – *T* = 4*ma**T* – 2 *mg* sin *α* – *F* = 2*ma* | M1A1M1A1 |
|  |  | **(4)** |
| **6(c)** | *F* = 0.25*R**R* =2*mg* cos *α*cos *α* = 0.8 or sin *α* = 0.6Eliminating *R*, *F* and *T**a* = 0.4*g* = 3.92 | B1B1B1M1A1 |
|  |  | **(5)** |
| **6(d)** |  | M1M1A1M1A1 A1 |
|  |  | **(6)** |
|  |  | **(16 marks)** |
| **7(a)** |  |  |  |
|  |  |
|  |  |
| For A:  | M1 A1 |
| For B: parallel to plane  | M1 A1 |
| perpendicular to plane  | M1 A1 |
|  | M1 |
|  |  |
| Eliminating *T*,  | DM1 |
| Equation in g and a:  | DM1 |
|  | A1 |
|  |  | **(10)** |
| **7(b)** | After 1 m, |  |
| ,  | M1 |
|   | A1 |
|  |  | **(2)** |
| **7(c)** |   | M1 |
|   | A1 |
|   | DM1 |
|  oe, 0.29. 0.286 | A1 |
|  |  | **(4)** |
|  |  | **(16 marks)** |
| **8(a)** |  | M1 A1M1 A1 |
|  |  | **(4)**  |
| **8(b)** |  | B1M1A1 |
|  |  | **(3)** |
| **8(c)** |  | M1A1 |
|  |  | **(2)** |
| **8(d)** |   (or *s* = (*d* – *h*)) | M1M1A1 (A1)A1A1 |
|  |  | **(5)** |
| **8(e)** | *A* (or *B*) would not move; **OR** *A* (or *B*) would remain in (limiting) equilibrium; **OR** the system would remain in (limiting) equilibrium | B1 |
|  |  | **(1)**  |
|  |  | **(15 marks)** |
| **9(a)** |  | M1B1M1 A1M1 A1**DM1** A1 |
|  |  | **(8)** |
| **9(b)** |   Direction is 45o below the horizontal oe | M1 A1A1B1 |
|  |  | **(4)** |
|  |  | **(12 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | M1 2014 | 2 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 3.1b, 3.4 |
| 2 | M1 Jan 2013 | 4 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 1.2, 2.2a, 3.3, 3.4 |
| 3 | M1 Jan 2011 | 4 |   | Vectors, Dynamics of a particle moving in a straight line or plane | 1.1b, 2.2a, 3.1a, 3.1b |
| 4 | M1 2013R | 7 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 2.2a, 3.1b, 3.3, 3.4 |
| 5 | M1 2014R | 7 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 2.1, 2.2a, 2.4, 3.1b |
| 6 | M1 Jan 2013 | 7 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 1.2, 2.1, 2.2a, 2.4, 3.1b, 3.4 |
| 7 | M1 Jan 2011 | 7 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 1.2, 2.1, 2.2a, 3.1b, 3.4 |
| 8 | M1 2017 | 8 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 2.2a, 3.3, 3.4, 3.5a |
| 9 | M1 2016 | 8 |   | Dynamics of a particle moving in a straight line or plane | 1.1b, 1.2, 2.1, 2.2a, 3.1b, 3.4 |