| **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 A1  M1 A1  M1 A1  B1 |
|  |  | | M1  A1 |
|  |  | | **(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* | | M1A1  M1A1 |
|  |  | | **(4)** |
| **6(c)** | *F* = 0.25*R*  *R* =2*mg* cos *α*  cos *α* = 0.8 or sin *α* = 0.6  Eliminating *R*, *F* and *T*  *a* = 0.4*g* = 3.92 | | B1  B1  B1  M1  A1 |
|  |  | | **(5)** |
| **6(d)** |  | | M1  M1  A1  M1  A1  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 A1  M1 A1 |
|  |  | | **(4)** |
| **8(b)** |  | | B1  M1  A1 |
|  |  | | **(3)** |
| **8(c)** |  | | M1  A1 |
|  |  | | **(2)** |
| **8(d)** | (or *s* = (*d* – *h*)) | | M1  M1  A1 (A1)  A1  A1 |
|  |  | | **(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)** |  | | M1  B1  M1 A1  M1 A1  **DM1** A1 |
|  |  | | **(8)** |
| **9(b)** | Direction is 45o below the horizontal oe | | M1 A1  A1  B1 |
|  |  | | **(4)** |
|  |  | | **(12 marks)** |

|  |  |  |  |  |  |
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|  | **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 |