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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **1a** | Integrate **v** w.r.t. time | **M1** | 1.1a | 8th  Solve general kinematics problems using calculus of vectors. |
| (Allow omission of **C**) | **A1** | 1.1b |
|  | **A1** | 1.1b |
|  | **(3)** |  |  |
| **1b** | Differentiate **v** w.r.t. time | **M1** | 1.1a | 8th  Solve general kinematics problems using calculus of vectors. |
|  | **A1** | 1.1b |
| Substitute *t* = 4 into **a** | **M1** | 1.1b |
| When *t* = 4,  (m s−2) | **A1** | 1.1b |
|  | **(4)** |  |  |
| **1c** | **j** component is 1 when *t* = 1 | **M1** | 3.1a | 8th  Solve general kinematics problems in a range of contexts using vectors. |
|  | When *t* = 1, **r** =**i** + **j**(m) | **A1** | 1.1b |
|  |  | **(2)** |  |  |
| (9 marks) | | | | |
| Notes | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **2a** | Differentiate **r** w.r.t. time | **M1** | 1.1a | 8th  Solve general kinematics problems using calculus of vectors. |
|  | **A1** | 1.1b |
|  | **A1** | 1.1b |
|  | **(3)** |  |  |
| **2b** |  | **B1** | 2.2a | 8th  Solve general kinematics problems in a range of contexts using vectors. |
|  | **(1)** |  |  |
| **2c** | **\\192.168.0.251\Pearson\A Level Maths\WIP files\Unit tests\Mechanics 2\Artwork\2. Files from YPS\alevel_ut_m2_u8_markscheme_aw1.png**  Diagram of circular orbit with velocity tangent to circle and acceleration pointing towards centre. Velocity must be in vertical direction. | **B1**  **B1** | 2.5  2.5 | 8th  Solve general kinematics problems in a range of contexts using vectors. |
|  | **(2)** |  |  |
| (6 marks) | | | | |
| Notes  **2c**  B1 for correct velocity direction  B1 for correct acceleration direction | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **3a** | **\\192.168.0.251\Pearson\A Level Maths\WIP files\Unit tests\Mechanics 2\Artwork\2. Files from YPS\alevel_ut_m2_u8_markscheme_aw2.png**  Diagram of two forces acting on ball. Weight (*g*) must be downwards and drag (*kv*) upwards. | **B1**  **B1** | 2.5  2.5 | 3rd  Draw force diagrams. |
|  | **(2)** |  |  |
| **3b** | Solve weight = drag for *v* | **M1** | 3.1b | 6th  Work with systems of forces in equilibrium. |
|  | **A1** | 1.1b |
|  | **(2)** |  |  |
| **3c** | Use ofwith *m* = 1 | **M1** | 1.1b | 5th  Use equations of motion to solve problems in familiar contexts. |
| is acceleration | **A1** | 1.2 |
| Total downward force is | **A1** | 3.4 |
|  | **(3)** |  |  |
| **3d** | Use of differentiation to evaluate both sides. | **M1** | 2.1 | 7th  Solve general kinematics problems in less familiar contexts. |
|  | **A1** | 2.1 |
|  | **A1** | 2.1 |
|  | **(3)** |  |  |
| **3e** | As the terminal velocity | **B1** | 3.2a | 7th  Solve general kinematics problems in less familiar contexts. |
|  | **(1)** |  |  |
| **3f** | Correct limitation | **B1** | 3.5b | 3rd  Understand assumptions common in mathematical modelling. |
|  |  | **(1)** |  |  |
| (12 marks) | | | | |
| Notes  **3a**  B1 for correct weight force labelled.  B1 for correct drag force labelled.  **3f**  For example,upthrust due to water pressure, drag proportional to velocity only at low velocity. | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **4a** | Integrate *a* w.r.t. *t* | **M1** | 1.1a | 5th  Use integration to determine functions for velocity and/or displacement. |
|  | **A1** | 1.1b |
|  | **(2)** |  |  |
| **4b** |  | **M1** | 3.1a | 7th  Solve general kinematics problems in less familiar contexts. |
|  | **A1** | 1.1b |
|  | **A1** | 2.4 |
| Breaking the speed limit between 20 and 40 minutes. | **A1** | 3.2a |
|  | **(4)** |  |  |
| **4c** | Integrate *v* w.r.t. *t* | **M1** | 1.1a | 5th  Use integration to determine functions for velocity and/or displacement. |
|  | **A1** | 1.1b |
| When | **A1** | 3.1b |
| Average speed = | **M1** | 1.1b |
| 30 km h−1 | **A1** | 1.1b |
|  | **(5)** |  |  |
| (11 marks) | | | | |
| Notes | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **5a** | Use of Newton’s second law. | **M1** | 3.1b | 8th  Understand general kinematics problems with vectors. |
|  | **M1** | 1.1b |
| (m s−2) | **A1** | 1.1b |
|  | **(3)** |  |  |
| **5b** | Integrate **a** | **M1** | 1.1a | 8th  Solve general kinematics problems using calculus of vectors. |
| (m s−1) | **A1** | 1.1b |
| because initially at rest. | **A1** | 2.4 |
| Integrate **v** | **M1** | 1.1a |
| (m) | **A1** | 1.1b |
| **c** = 0 because initially at origin. | **A1** | 2.4 |
|  | **(6)** |  |  |
| **5c** | Subsititute *t* = 1 | **M1** | 1.1a | 6th  Understand general kinematics problems with vectors. |
|  | **M1** | 1.1b |
| (m s−1) | **A1** | 1.1b |
|  |  | **(3)** |  |
| (12 marks) | | | | |
| Notes | | | | |