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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **1a** | One of: * to obtain a representative sample
* large number of students compared to staff so would be unfair to take same numbers of both.
 | **B1** | 2.4 | 5thSelect and critique a sampling technique in a given context. |
|  | **(1)** |  |  |
| **1b** | A list of the names of staff and students. | **B1** | 1.2 | 2ndUnderstand the vocabulary of sampling. |
|  | **(1)** |  |  |
| **1c** | A member of staff or a student. | **B1** | 1.2 | 2ndUnderstand the vocabulary of sampling. |
|  | **(1)** |  |  |
| **1d** | Find proportions for different strata out of 60 (either explained or some sensible calculation seen). | **M1** | 3.1b | 3rdUnderstand and carry out stratified sampling. |
|  students,  staff. | **A1** | 1.1b |
| Select at random using a random number generator. | **B1** | 1.1b |
|  | **(3)** |  |  |
| **1e** | One of: * absence on the day of the survey
* sampling frame may contain errors.
 | **B1** | 2.2b | 5thSelect and critique a sampling technique in a given context. |
|  | **(1)** |  |  |
| **(7 marks)**  |
| **Notes****1d** Must be whole numbers for A1.  |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **2a** | Order the data.125, 160, 169, 171, 175, 186, 210, 243, 250, 258, 390, 420 | **M1** | 1.1b | 2ndUnderstand quartiles and percentiles. |
| *Q*3 =(250 + 258) = 254 | **A1** | 1.1b |
|  | **(2)** |  |  |
| **2b** | *Q*3 +1.5(*Q*3 – *Q*1) = 254 + 1.5(254 – 170)  | **M1** | 1.1b | 4thCalculate outliers in data sets and clean data. |
| = 380 | **A1** | 1.1b |
| Patients *F* (420) and *B* (390) are outliers (so may be suspected by the doctor as smoking more than one packet of cigarettes per day). | **B1** | 3.2a |
|  | **(3)** |  |  |
| **(5 marks)**  |
| **Notes** |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **3a** | or awrt 0.167 | **M1****A1** | 1.1b1.1b | 1stCalculate probabilities for single events. |
|  | **(2)** |  |  |
| **3b** |   | **M1** | 1.1b | 3rdUnderstand and use Venn diagrams for multiple events. |
|  | **A1** | 1.1b |
|  | **(2)** |  |  |
| **3c** | 0 | **B1** | 1.1b | 3rdUnderstand and use the definition of mutually exclusive in probability calculations. |
| No student reads both magazine *A* and magazine *C*. | **B1** | 1.1b |
|  | **(2)** |  |  |
| **3d** |  | **B1** | 1.1b | 3rdUnderstand and use Venn diagrams for multiple events. |
|  | **(1)** |  |  |
| **3e** |  | **B1** | 2.1 | 4thUnderstand and use the definition of independence in probability calculations. |
| , and | **M1** | 2.2a |
| So yes, they are independent. | **A1** | 2.4 |
|  | **(3)** |  |  |
| **(10 marks)** |
| **Notes****3e**Allow alternative using formal conditional probability: P(*B*) =  (B1). Finding P(*B*|*C*) =  and comparing with P(*B*) (M1). Correct conclusion (A1).Or P(*C*) =  (B1). Finding P(*C*|*B*) =  and comparing with P(*C*) (M1). Correct conclusion (A1). |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **4a** | 2*k* + *k* + 0 + *k* = 1 | **M1** | 2.1 | 4thCalculate probabilities from discrete distributions. |
| 4*k* = 1, so *k* = 0.25 (answer given). | **A1\*** | 1.1b |
|  | **(2)** |  |  |
| **4b** | P(*X*1 + *X*2 = 5) = P(*X*1 = 3 and *X*2 = 2) + P(*X*1 = 2 and *X*2 = 3) = 0 + 0 = 0 (answer given). | **B1\*** | 2.4 | 4thCalculate probabilities from discrete distributions. |
|  | **(1)** |  |  |
| **4c** |

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| *x*1 + *x*2 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| P(*X*1 + *X*2) | 0.25 | 0.25 | 0.0625 | 0.25 | 0.125 | 0 | 0.0625 |

 | **M1****A1****A1** | 2.51.1b1.1b | 4thCalculate probabilities from discrete distributions. |
|  | **(3)** |  |  |
| **4d** | P(1.3 ⩽ *X*1 + *X*2 ⩽ 3.2) = P(*X*1 + *X*2 = 2) + P(*X*1 + *X*2 = 3) | **M1** | 3.4 | 4thCalculate probabilities from discrete distributions. |
| = 0.0625 + 0.25 = 0.3125 or | **A1ft** | 1.1b |
|  | **(2)** |  |  |
| **(8 marks)**  |
| **Notes****4b**Must show that 5 can only be obtained from 2 and 3 or 3 and 2, and so must use P(*X* = 2) = 0 but condone explanation in words.**4c**M1 for correct set of values for *X*1 + *X*2. Condone omission of 5 column. A1 for correct probabilities for 0, 2 and 6. A1 for others. Equivalent fractions are  |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **5a** | States correct answer: 5.3 (m s−1) | **B1** | 2.2a | 4thUnderstand the difference between a scalar and a vector. |
|  | **(1)** |  |  |
| **5b** | States correct answer: −4.8 (m s−1) | **B1** | 2.2a | 4thUnderstand the difference between a scalar and a vector. |
|  | **(1)** |  |  |
| **5c** | States correct answer: −30 (m) | **B1** | 2.2a | 4thUnderstand the difference between a scalar and a vector. |
|  | **(1)** |  |  |
| **(3 marks)**  |
| **Notes** |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **6a** | **Figure 1** | General shape of the graph is correct. i.e. horizontal line, followed by negative gradient, followed by a positive gradient. | **M1** | 3.3 | 4thUse and interpret graphs of velocity against time. |
| Vertical axis labelled correctly. | **A1** | 1.1b |
| Horizontal axis labelled correctly. | **A1** | 1.1b |
|  | **(3)** |  |  |
| **6b** | Makes an attempt to find the area of trapezoidal section where the car is decelerating. For example,is seen. | **M1** | 1.1b | 4thCalculate and interpret areas under velocity–time graphs. |
| Makes an attempt to find the area of the trapezoidal section where the car is accelerating. For example,is seen. | **M1** | 1.1b |
| States that  | **M1** | 1.1b |
| Solves to find the value of *T*: *T* = 30 (s). | **A1** | 1.1b |
|  | **(4)** |  |  |
| **(7 marks)**  |
| **Notes****6a**Accept the horizontal axis labelled with the correct intervals.**6b**Award full marks for correct final answer, even if some work is missing. |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **7a** | States, or implies in a subsequent step, that the resistances to motion will total 1600*k* (N). (Any variable is acceptable.) | **M1** | 3.1b | 4thSolve problems of connected particles in one dimension. |
| Uses *F* = *ma* to write  | **M1** | 3.3 |
| Solves the equation to find *k* = 1.6 | **A1** | 1.1b |
| Finds the resistance forces acting on the trailer:(N). | **A1** | 1.1b |
|  | **(4)** |  |  |
| **7b** | Demonstrates an understanding that the resultant force for the trailer is *T* – 640, or for the car is 3200 – 1920 – *T* | **M1** | 3.1b | 4thSolve problems of connected particles in one dimension. |
| Either states using the trailer or states using the car. | **M1** | 3.3 |
| Correctly finds *T* = 800 (N). | **A1 ft** | 1.1b |
|  | **(3)** |  |  |
| **7c** | Uses *F* = *ma* to write −640 = 400*a* | **M1** | 3.3 | 4thSolve problems of connected particles in one dimension. |
| Correctly solves to find *a* = −1.6 m s−2 | **A1 ft** | 1.1b |
| Uses  to write  | **M1** | 3.1b |
| Correctly solves to find *s* = 195.31… (m). Accept awrt 195 (m). | **A1 ft** | 1.1b |
|  | **(4)** |  |  |
| **7d** | States ‘the acceleration of the car will be equal to the acceleration of the trailer’ or states ‘the car and the trailer will move as one’. | **B1** | 3.5 | 4thSolve problems of connected particles in one dimension. |
|  | **(1)** |  |  |
| **(12 marks)**  |
| **Notes****7b**Award ft marks for a correct answer using their value from part **a** for the resistance acting on the trailer.**7c**Award ft marks for a correct answer using their value from part **a** for the resistance acting on the trailer and from part **b** for tension. |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **8** | Integrates  to obtain  Any constant is acceptable. | **M1** | 3.1b | 6thUses integration to solve problems in kinematics. |
| Integrates to obtain. Any constant are acceptable. | **M1** | 3.1b |
| Makes an attempt to form a pair of simultaneous equations by separately substituting (1, 2) and (3, 30) into the equation. For example:  and  are seen. | **M1** | 3.1b |
| Simplifies to obtain a correctly pair of simultaneous equations:  and  are seen. | **M1** | 1.1b |
| Solves to find *A* = −4 | **A1** | 1.1b |
| Solves to find *B* = 6 | **A1** | 1.1b |
| Attempts to make a substitution of *t* = 2 into For example,  is seen. | **M1** | 1.1b |
| Correctly finds *s* = 6 (m). | **A1 ft** | 1.1b |
|  | **(8)** |  |  |
| **(8 marks)**  |
| **Notes****8**Award the final method mark and the final accuracy mark for a correct substitution using their values for *A* and *B*. |