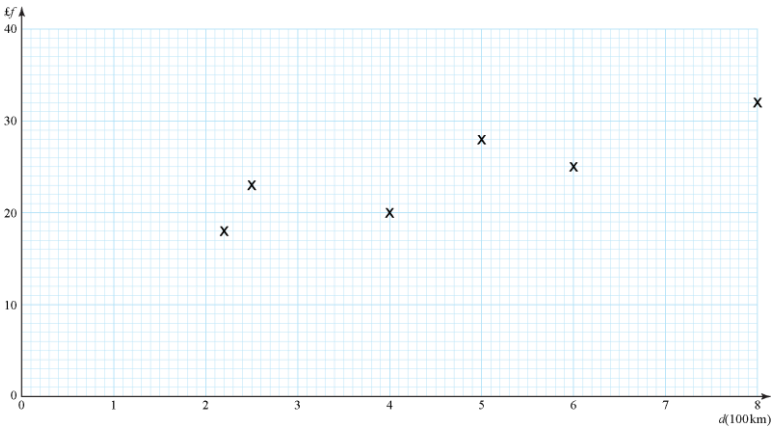


AS Practice Paper H (Statistics & Mechanics) mark scheme

| Q                | Scheme                                                                                                                                                                          | Marks                  | AOs        | Pearson Progression Step and Progress descriptor                    |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------|---------------------------------------------------------------------|
| 1a               | Quota.                                                                                                                                                                          | <b>B1</b>              | 1.2        | 3rd<br>Understand quota and opportunity sampling.                   |
|                  |                                                                                                                                                                                 | <b>(1)</b>             |            |                                                                     |
| 1b               | Advantages – two from: <ul style="list-style-type: none"> <li>easy to get sample size</li> <li>inexpensive</li> <li>fast</li> <li>can be stratified if required.</li> </ul>     | <b>B1</b><br><b>B1</b> | 2.4<br>2.4 | 5th<br>Select and critique a sampling technique in a given context. |
|                  | Disadvantages – one from: <ul style="list-style-type: none"> <li>not random</li> <li>could be biased.</li> </ul>                                                                | <b>B1</b>              | 2.4        |                                                                     |
|                  |                                                                                                                                                                                 | <b>(3)</b>             |            |                                                                     |
|                  |                                                                                                                                                                                 |                        |            |                                                                     |
| 1c               | Allocate each of the males a number from 1 to 300                                                                                                                               | <b>B1</b>              | 3.1b       | 3rd<br>Understand and carry out simple random sampling.             |
|                  | Use calculator or number generator to generate 50 different random numbers from 1 to 300 inclusive.                                                                             | <b>B1</b>              | 1.1b       |                                                                     |
|                  | Select males corresponding to those numbers.                                                                                                                                    | <b>B1</b>              | 1.1b       |                                                                     |
|                  |                                                                                                                                                                                 | <b>(3)</b>             |            |                                                                     |
| 1d               | $300 \div 50 = 6$                                                                                                                                                               | <b>B1</b>              | 3.1b       | 3rd<br>Understand and carry out simple random sampling.             |
|                  | Use a random number generator to select the first name (or one of the first 6 names on the list) as a starting point and then select every 6th name thereafter to get 50 names. | <b>B1</b>              | 1.1b       |                                                                     |
|                  |                                                                                                                                                                                 | <b>(2)</b>             |            |                                                                     |
| <b>(9 marks)</b> |                                                                                                                                                                                 |                        |            |                                                                     |
| <b>Notes</b>     |                                                                                                                                                                                 |                        |            |                                                                     |

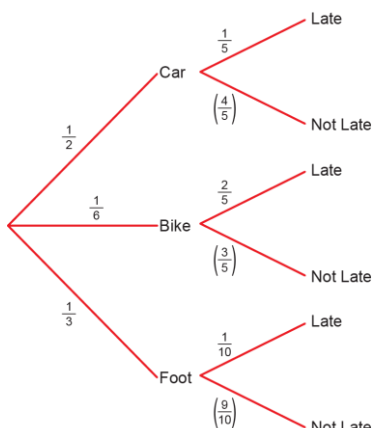
## AS Practice Paper H (Statistics &amp; Mechanics) mark scheme

| Q  | Scheme                                                                                                                                                                | Marks | AOs  | Pearson Progression Step and Progress descriptor                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|--------------------------------------------------------------------------------------------|
| 2a | <p>All points correctly plotted.</p>                                                | B2    | 1.1b | <p>2nd</p> <p>Draw and interpret scatter diagrams for bivariate data.</p>                  |
|    |                                                                                                                                                                       | (2)   |      |                                                                                            |
| 2b | <p>The <b>points</b> lie reasonably close to a <b>straight line</b> (o.e.).</p>                                                                                       | B1    | 2.4  | <p>2nd</p> <p>Draw and interpret scatter diagrams for bivariate data.</p>                  |
|    |                                                                                                                                                                       | (1)   |      |                                                                                            |
| 2c | $f$                                                                                                                                                                   | B1    | 1.2  | <p>2nd</p> <p>Know and understand the language of correlation and regression.</p>          |
|    |                                                                                                                                                                       | (1)   |      |                                                                                            |
| 2d | <p>Line of best fit plotted for at least <math>2.2 \leq x \leq 8</math> with <math>D</math> and <math>F</math> above and <math>B</math> and <math>C</math> below.</p> | M1    | 1.1a | <p>4th</p> <p>Make predictions using the regression line within the range of the data.</p> |
|    | <p>26 to 31 inclusive (must be correctly read from <math>x = 7</math> from the line of best fit).</p>                                                                 | A1    | 1.1b |                                                                                            |
|    |                                                                                                                                                                       | (2)   |      |                                                                                            |

**AS Practice Paper H (Statistics & Mechanics) mark scheme**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   |            |     |                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------|-----|--------------------------------------------------------------------|
| <b>2e</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | It is reliable because it is interpolation (700 km is within the range of values collected).                      | <b>B1</b>  | 2.4 | 4th<br>Understand the concepts of interpolation and extrapolation. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   | <b>(1)</b> |     |                                                                    |
| <b>2f</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | No, it is not sensible since this would be extrapolation (as 180 km is outside the range of distances collected). | <b>B1</b>  | 2.4 | 4th<br>Understand the concepts of interpolation and extrapolation. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   | <b>(1)</b> |     |                                                                    |
| <b>(8 marks)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                   |            |     |                                                                    |
| <p style="text-align: center;"><b>Notes</b></p> <p><b>2a</b><br/>First B1 for at least 4 points correct, second B1 for all points correct.</p> <p><b>2b</b><br/>Do not accept 'The points lie reasonably close to a line'. Linear or straight need to be noted.</p> <p><b>2e</b><br/>Also allow 'It is reliable because the points lie reasonably close to a straight line'.</p> <p><b>2f</b><br/>Allow the answer 'It is sensible since even though it is extrapolation it is not by much' provided that the answer contains both ideas (i.e. it IS extrapolation but by a small amount compared to the given range of data).</p> |                                                                                                                   |            |     |                                                                    |

## AS Practice Paper H (Statistics &amp; Mechanics) mark scheme

| Q                                                                                                                                                                                  | Scheme                                                                                                                                                                     | Marks                               | AOs                  | Pearson Progression Step and Progress descriptor                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------|----------------------------------------------------------------------------|
| 3a                                                                                                                                                                                 |  <p>Correct tree structure.<br/>All labels correct.<br/>All probabilities correct.</p>    | <b>B1</b><br><b>B1</b><br><b>B1</b> | 3.1a<br>1.1b<br>1.1b | 3rd<br>Draw and use tree diagrams with three branches and/or three levels. |
|                                                                                                                                                                                    |                                                                                                                                                                            | <b>(3)</b>                          |                      |                                                                            |
| 3bi                                                                                                                                                                                | $\frac{1}{3} \times \frac{1}{10} = \frac{1}{30}$ or equivalent.                                                                                                            | <b>M1</b><br><b>A1</b>              | 3.4<br>1.1b          | 3rd<br>Draw and use tree diagrams with three branches and/or three levels. |
|                                                                                                                                                                                    |                                                                                                                                                                            | <b>(2)</b>                          |                      |                                                                            |
| 3bii                                                                                                                                                                               | Car NL + Bike NL + Foot NL<br>$= \left(\frac{1}{2} \times \frac{4}{5}\right) + \left(\frac{1}{6} \times \frac{3}{5}\right) + \left(\frac{1}{3} \times \frac{9}{10}\right)$ | <b>M1</b>                           | 3.4                  | 3rd<br>Draw and use tree diagrams with three branches and/or three levels. |
|                                                                                                                                                                                    | $= \frac{4}{5}$ or equivalent.                                                                                                                                             | <b>A1</b>                           | 1.1b                 |                                                                            |
|                                                                                                                                                                                    |                                                                                                                                                                            | <b>(2)</b>                          |                      |                                                                            |
| <b>(7 marks)</b>                                                                                                                                                                   |                                                                                                                                                                            |                                     |                      |                                                                            |
| <b>Notes</b>                                                                                                                                                                       |                                                                                                                                                                            |                                     |                      |                                                                            |
| <b>3bii</b><br>ft from their tree diagram. Allow one error for M1.                                                                                                                 |                                                                                                                                                                            |                                     |                      |                                                                            |
| Can also be found from $1 - \left(\left(\frac{1}{2} \times \frac{1}{5}\right) + \left(\frac{1}{6} \times \frac{2}{5}\right) + \left(\frac{1}{3} \times \frac{1}{10}\right)\right)$ |                                                                                                                                                                            |                                     |                      |                                                                            |

AS Practice Paper H (Statistics & Mechanics) mark scheme

| Q                | Scheme                                                                                                                                                                                                                                                                                                                                                                                                                           | Marks                     | AOs          | Pearson Progression Step and Progress descriptor                                       |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------|----------------------------------------------------------------------------------------|
| 4a               | Two from: <ul style="list-style-type: none"> <li>Each bolt is either faulty or not faulty.</li> <li>The probability of a bolt being faulty (or not) may be assumed constant.</li> <li>Whether one bolt is faulty (or not) may be assumed to be independent (or does not affect the probability of) whether another bolt is faulty (or not).</li> <li>There is a fixed number (50) of bolts.</li> <li>A random sample.</li> </ul> | <b>B2</b>                 | 1.2<br>1.2   | 5th<br>Understand the binomial distribution (and its notation) and its use as a model. |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>(2)</b>                |              |                                                                                        |
| 4b               | Let $X$ represent the number of faulty bolts.<br>$X \sim B(50, 0.25)$<br>$P(X \leq 6) = 0.0194$<br>$P(X \leq 7) = 0.0453$<br>$P(X \geq 19) = 0.0287$<br>$P(X \geq 20) = 0.0139$                                                                                                                                                                                                                                                  | <b>M1</b><br><b>M1dep</b> | 3.4<br>1.1b  | 5th<br>Find critical values and critical regions for a binomial distribution.          |
|                  | Critical Region is $X \leq 6 \cup X \geq 20$                                                                                                                                                                                                                                                                                                                                                                                     | <b>A2</b>                 | 1.1b<br>1.1b |                                                                                        |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>(4)</b>                |              |                                                                                        |
| <b>(6 marks)</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |              |                                                                                        |
| <b>Notes</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |              |                                                                                        |
| <b>4a</b>        | Each comment must be in context for its mark.                                                                                                                                                                                                                                                                                                                                                                                    |                           |              |                                                                                        |

AS Practice Paper H (Statistics & Mechanics) mark scheme

| Q                                                                                                                                                                                                                                  | Scheme                                                                                                                                                                                                                                                                                                                                                                             | Marks | AOs  | Pearson Progression Step and Progress descriptor                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|-----------------------------------------------------------------|
| 5a                                                                                                                                                                                                                                 | Makes an attempt to find the absolute value. For example, $\sqrt{(14)^2 + (22)^2}$ is seen.                                                                                                                                                                                                                                                                                        | M1    | 3.1b | 4th<br>Find the magnitude and direction of a vector quantity.   |
|                                                                                                                                                                                                                                    | Simplifies to $\sqrt{680}$                                                                                                                                                                                                                                                                                                                                                         | M1    | 1.1b |                                                                 |
|                                                                                                                                                                                                                                    | Finds speed = 26.07... (ms <sup>-1</sup> )<br>Accept awrt 26.1 (ms <sup>-1</sup> )                                                                                                                                                                                                                                                                                                 | A1    | 1.1b |                                                                 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                    | (3)   |      |                                                                 |
| 5b                                                                                                                                                                                                                                 | States that $\tan \theta = \frac{22}{14}$                                                                                                                                                                                                                                                                                                                                          | M1    | 1.1b | 4th<br>Find the magnitude and direction of a vector quantity.   |
|                                                                                                                                                                                                                                    | Finds the value of $\theta$ , $\theta = 57.52...$                                                                                                                                                                                                                                                                                                                                  | A1    | 1.1b |                                                                 |
|                                                                                                                                                                                                                                    | Demonstrates that the angle with the unit <b>j</b> vector is $90 - 57.52...$                                                                                                                                                                                                                                                                                                       | M1    | 1.1b |                                                                 |
|                                                                                                                                                                                                                                    | Finds 32.47... (°)<br>Accept awrt 32.5(°)                                                                                                                                                                                                                                                                                                                                          | A1    | 1.1b |                                                                 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                    | (4)   |      |                                                                 |
| 5c                                                                                                                                                                                                                                 | Ignore the value of friction between the hockey puck and the ice.                                                                                                                                                                                                                                                                                                                  | B1    | 3.4  | 3rd<br>Understand assumptions common in mathematical modelling. |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                    | (1)   |      |                                                                 |
| 5d                                                                                                                                                                                                                                 | $\frac{1.4 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{100 \text{ cm}}{1 \text{ m}}$<br>Award 1 method mark for division by 1000 and 1 method mark for multiplication by 100 only once and the final method mark for multiplication by 100 three times. | M3    | 1.1b | 4th<br>Know derived quantities and SI units.                    |
|                                                                                                                                                                                                                                    | 1400 kg m <sup>-3</sup>                                                                                                                                                                                                                                                                                                                                                            | A1    | 1.1b |                                                                 |
|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                    | (4)   |      |                                                                 |
| (12 marks)                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                    |       |      |                                                                 |
| Notes                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                    |       |      |                                                                 |
| <p>5b</p> <p>Award all 4 marks for a correct final answer. Award 2 marks for a student stating <math>\tan \theta = \frac{14}{22}</math>, and then either making a mistake with the inverse or subtracting that answer from 90.</p> |                                                                                                                                                                                                                                                                                                                                                                                    |       |      |                                                                 |

AS Practice Paper H (Statistics & Mechanics) mark scheme

| Q                                                                                                                                                                   | Scheme                                                                                                                                                  | Marks | AOs  | Pearson Progression Step and Progress descriptor             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|--------------------------------------------------------------|
| 6                                                                                                                                                                   | Makes an attempt to integrate $a = \frac{1}{500}(20t^2 - t^3)$<br>Raising power by one would constitute an attempt.                                     | M1    | 3.1b | 6th<br>Uses differentiation to solve problems in kinematics. |
|                                                                                                                                                                     | Correctly finds $v = \frac{1}{500}\left(\frac{20}{3}t^3 - \frac{1}{4}t^4\right)$ . Note that $C = 0$ .                                                  | A1    | 1.1b |                                                              |
|                                                                                                                                                                     | Makes an attempt to integrate $v = \frac{1}{500}\left(\frac{20}{3}t^3 - \frac{1}{4}t^4\right)$ . Raising power by one would constitute an attempt.      | M1    | 3.1b |                                                              |
|                                                                                                                                                                     | Correctly finds $s = \frac{1}{500}\left(\frac{20}{12}t^4 - \frac{1}{20}t^5\right)$ . Note that $C = 0$ .                                                | A1    | 1.1b |                                                              |
|                                                                                                                                                                     | Substitutes $t = 10$ into $s = \frac{1}{500}\left(\frac{20}{12}t^4 - \frac{1}{20}t^5\right)$ to obtain<br>$s = \frac{70}{3}$ (m). Accept awrt 23.3 (m). | A1 ft | 1.1b |                                                              |
|                                                                                                                                                                     |                                                                                                                                                         | (5)   |      |                                                              |
| (5 marks)                                                                                                                                                           |                                                                                                                                                         |       |      |                                                              |
| <p style="text-align: center;"><b>Notes</b></p> <p><b>6</b><br/>Award the final accuracy mark for a correct substitution using their equation for displacement.</p> |                                                                                                                                                         |       |      |                                                              |

AS Practice Paper H (Statistics & Mechanics) mark scheme

| Q          | Scheme                                                                                                                                                                    | Marks | AOs  | Pearson Progression Step and Progress descriptor                             |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------------------------------------------------------------------------------|
| 7a         | Makes an attempt to substitute $t = 25$ into $s = 30t - 0.4t^2$ .<br>For example $s = 30(25) - 0.4(25)^2$ is seen.                                                        | M1    | 1.1b | 5th<br><br>Use equations of motion to solve problems in unfamiliar contexts. |
|            | Correctly states that $AB = 500$ (m). Accept $s = 500$ (m).                                                                                                               | A1    | 1.1b |                                                                              |
|            |                                                                                                                                                                           | (2)   |      |                                                                              |
| 7b         | Differentiates $s = 30t - 0.4t^2$ to obtain $v = 30 - 0.8t$                                                                                                               | M1    | 3.1b | 6th<br><br>Solve problems using calculus and the equations of motion.        |
|            | Differentiates $v = 30 - 0.8t$ to obtain $a = -0.8$                                                                                                                       | M1    | 3.1b |                                                                              |
|            | States that $a = -0.8$ ( $\text{m s}^{-2}$ ) is a constant as it does not depend on $t$ .                                                                                 | A1    | 3.5a |                                                                              |
|            |                                                                                                                                                                           | (3)   |      |                                                                              |
| 7c         | States distance of the car from point A is $s_1 = 30t - 0.4t^2$                                                                                                           | M1    | 3.3  | 6th<br><br>Solve problems using calculus and the equations of motion.        |
|            | $u = 2$ and $a = 0.1$ and an attempt to use $s = ut + \frac{1}{2}at^2$ is seen.                                                                                           | M1    | 3.3  |                                                                              |
|            | States distance of the runner from point B is $s_2 = 2t + 0.05t^2$                                                                                                        | M1    | 1.1b |                                                                              |
|            | States that the runner and the car will pass each other when their distances total 500 (m), or writes $s_1 + s_2 = 500$ (m) or writes $30t - 0.4t^2 + 2t + 0.05t^2 = 500$ | M1    | 3.3  |                                                                              |
|            | States that $0.35t^2 - 32t + 500 = 0$ or equivalent.                                                                                                                      | A1    | 1.1b |                                                                              |
|            | Solves to find $t = 20$ (s). Answer does not need to state that $t = \frac{500}{7}$ or 71.4... (s) is not in the given range.                                             | A1    | 1.1b |                                                                              |
|            | Makes an attempt to substitute $t = 20$ into $s_1 = 30t - 0.4t^2$ or $s_2 = 2t + 0.05t^2$ .                                                                               | M1    | 1.1b |                                                                              |
|            | Correctly states they will pass each other 440 (m) from A or 60 (m) from B.                                                                                               | A1 ft | 3.5a |                                                                              |
|            |                                                                                                                                                                           | (8)   |      |                                                                              |
| (13 marks) |                                                                                                                                                                           |       |      |                                                                              |
| Notes      |                                                                                                                                                                           |       |      |                                                                              |