| Question number | | Answer | Notes | Marks |
|---|---|---|---|---|
| 5 (a) | | 15 (N) | | 1 |
| (b) | (i) | Scale on axes is linear - 1 mark<br>Axes labelled with scales and units - 1 mark<br>Plotting to nearest half-square (minus one for each plotting / scale error, up to max 2 marks) - 2 marks<br>Line (straight) of best fit acceptable - 1 mark | ALLOW 'mass' / 'scale reading' for y-axis<br><br><br>Bar charts: can only score S, A and P marks (4 max) | 5 |
| | (ii) | (4, 3.7) identified / circled ; | | 1 |
| (c) | | Any **four** from:<br><br>Data<br>• There is an obvious error / anomaly / inconsistency in the readings ;<br>• The data on the tin may be wrong ;<br>• The extension of spring might not be linear / broken scales / scales not obeying Hookes Law ;<br>• There is a zero error ;<br>• There could be reading error / parallax error ;<br><br>Methods<br>• The conclusion was based on just one pair of readings ;<br>• The experiment was not repeated ;<br>• The weight of tins / bag was not taken into account ;<br>• (0 – 5kg is an) inadequate range to measure schoolbag ; | | 4 |

**Total 11 marks**

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| 7 | (a) | | momentum = mass x velocity OR  72 x 8 ;<br><br>Calculation        580 (kg m/s); | Or equivalent rearrangement<br>ACCEPT use of standard abbreviations i.e. p = mv<br>ALLOW 576 (kg m/s) | 2 |
| | (b) | | Substitution        920 ÷ 0.17 ;<br>Calculation         5400 (N) ; | REJECT Alternative incorrect unit for 1 mark<br>ACCEPT 5410 / 5412 / 5411.7…… 5411.8<br>REJECT 5411 | 2 |
| | (c) | (i) | Any **two** from:<br><br>Road<br>Weather-related e.g. wet / dry / rainy / icy ;<br>Surface-related e.g. gravel / mud / freshly tarmaced / oily ;<br>Gradient e.g. uphill / downhill ;<br>Car<br>Mechanical e.g. quality of tyres / brakes ;<br>Momentum-related e.g. speed / number of passengers / mass ;<br>Driver<br>State of alertness e.g. tired / alcohol / drugs / mobile phone / other distractions ;<br>Reaction time ; | ALLOW slippery if qualified | 2 |

| 7 | (c) | (ii) | Any **three** from:<br><br>• Car (and driver) take longer to slow down / time for crash increases ;<br>• Momentum changes / decreases ;<br>• Rate of change of momentum (and thus force) reduced ;<br>• <u>Smaller force</u> leads to less severe injuries ;<br>**OR**<br>• Driver travels further in crash / for a longer time ;<br>• Acceleration / deceleration (and thus force) is lower ;<br>• Rate of change of momentum (and thus force) reduced ;<br>• <u>Smaller force</u> leads to less severe injuries ; | ALLOW reverse arguments e.g. "If no crumple zone…"<br><br>NB "change of momentum, divided by time is <u>less</u>"<br>scores two marks | 3 |

**Total 9 marks**