

Question	Answer	Mark
1(a)(i)	(momentum =) $mv$ OR $70 \times 20$ = $1400 \text{ kg m/s}$ OR $\text{Ns}$	<b>C1</b> <b>A1</b>
a)(ii)	same numerical answer as <b>(a)(i)</b> with either unit OR $1400 \text{ kg m/s}$	<b>B1</b>
(b)	(a = ) change of velocity/time OR $(v - u)/t$ OR $20/0.2$  $100 \text{ m/s}^2$	<b>C1</b> <b>A1</b>
(c)	(F =) $ma$ OR $70 \times 80$ $5600 \text{ N}$	<b>C1</b> <b>A1</b>
(d)	Force/impact on passenger or dummy less (than without seat belt/airbag) Passenger less likely to be injured/hurt/damaged	<b>M1</b> <b>A1</b>

**Total: 9**

- 2 (a)  $mv - mu$  OR  $m(v - u)$  OR  $mv$  OR  $0.15 \times 8.0$  C1  
 $1.2 \text{Ns}$  or  $\text{kgm/s}$  A
- (b)  $1.2 \text{Ns}$  or  $\text{kgm/s}$  B
- (c)  $F = (mv - mu)/t$  OR  $F = mv/t$  OR impulse/t OR  $1.2/0.0015$  A1  
 $800 \text{N}$   
OR  
 $(F =) ma$  OR  $m[(v - u)/t]$  OR  $0.15 \times 8/0.0015$   
 $800 \text{N}$  (A1)

**[Total: 5]**

- 3 (a)  $p = mv$  in any form, words or symbols [1]  
0.16 kg m/s OR N s [1]
- (b) use of principle of conservation of momentum in words, symbols or numbers [1]  
use of combined mass 0.5(0) + 0.3(0) OR 0.8(0) (kg) [1]  
0.2(0) m/s [1]
- 4 (a) ( $p =$ )  $F/A$  OR in words OR 90/4.8 OR 90 / 0.00048 C1  
= 18.75 N/cm<sup>2</sup> OR 1.875 × 10<sup>5</sup> Pa OR 187500 Pa  
OR 187.5 kPa OR 0.1875 MPa at least 2 s.f. A1
- (b) Area of Y bigger (than area of X so force greater) B1
- (c) Volume of oil moved at Y = volume of oil moved at X B1  
Area of Y × distance moved by Y = Area of X × distance moved by X (so distance  
move by Y smaller) B1  
OR  
Work done by piston X = work done on piston Y (B1)  
Work = force × distance and  $F_2$  is greater than  $F_1$  so distance moved by Y smaller  
(than distance moved by X) (B1)
- (d) Air bubbles compress when pressure applied M1  
More movement of piston X required for same movement of piston Y  
OR Y moves less (for same movement of X)  
OR Driver must push the brake pedal further / do more work  
OR Pressure reduced / force on Y reduced  
OR System is less efficient A1

**[Total: 7]**