

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

Total: 9

- 2 (a) $mv - mu$ OR $m(v - u)$ OR mv OR 0.15×8.0 C1
 1.2Ns or kgm/s A
- (b) 1.2Ns or kgm/s B
- (c) $F = (mv - mu)/t$ OR $F = mv/t$ OR impulse/ t OR $1.2/0.0015$ A1
 800N
OR
($F =$) ma OR $m[(v - u)/t]$ OR $0.15 \times 8/0.0015$
 800N (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
 $= 18.75 \text{ N/cm}^2$ OR $1.875 \times 10^5 \text{ Pa}$ 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 \times distance moved by Y = Area of X \times 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 \times 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]