Assess Quizzes from the o-book – Explanations for the answers.

Chapter 12 Review – Support

Q	Reason
1	It is a vector quantity because it is made up of a scalar (mass) and a vector (velocity) and so it has direction. As it is $m \times v$ it has the units *kilogram metres per second* and the symbol kg m s^{-1}.
2	The longer the time for the change in momentum the lower the maximum force as $F = \frac{\Delta p}{t}$. Thus, the nets will be subjected to a lower force which they would be able to cope with without breaking. Admittedly, it would be over a longer time.
3	See the definition on page 340. There are two correct but irrelevant options as well: momentum is m × v, and momentum is also F × t. Be warned that the other option ($p_{initial} = p_{final}$) is only true when no outside forces are involved. Watch this trap.
4	If the ball stays in his system (held on by his hands) he may move back when he pushes the ball forward but will move backwards when he pulls the ball towards himself. The net effect is that he stays in the same place (no net recoil).
5	In an elastic collision the particles have to rebound. To be fully elastic they have to suffer no loss of kinetic energy in total. Billiard balls come close to being elastic so it is the best alternative.
6	Can be either. If is bounces off it is more likely to be elastic; if they stick together they are inelastic.
7	$p = mv$ $10000 = m \times 5$ $m = 2000\,kg$
8	$F = \frac{mv - mu}{t}$ so, if we increase the time the force gets smaller. Of course, it is a smaller force but over a longer time.
9	$Ft = m(v-u)$ $F = \frac{m(v-u)}{t}$ $F = \frac{0.16 \times (0-25)}{0.003} = 1333\,N$

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10	$p_i = p_f$ $m_1u_1 + m_2u_2 = (m_1 + m_2)v\ [note\,that\ m_2 = 2m_1]$ $m_1u_1 + 2m_1 \times 0 = (m_1 + 2m_1)v$ $m_1u_1 = 3m_1 \times v$ $u_1 = 3v$ $v = \frac{1}{3}u_1$

Chapter 12 Review – Consolidate

Q	Reason
1	$p = mv = \frac{23.1}{1000} \times 621 = 14.3\,kg\,m\,s^{-1}\ (14.3\,N\,s)$ To see how the two units are equivalent, see dot point 5 page 336.
2	$p_i = p_f$ $m_1u_1 + m_2u_2 = (m_1 + m_2)v\ [coupled\ \&\ inelastic]$ $90 \times 0 + (10 \times +20) = (90 + 10)v$ $+200 = 100 \times v$ $v = \frac{+200}{100} = +2\,m\,s^{-1}\ [same\,direction\,(+)\,as\,the\,ball]$
3	$p_i = p_f$ $m_1u_1 + m_2u_2 = (m_1 + m_2)v\ [coupled\ \&\ inelastic]$ $1500 \times (+80) + 1000 \times (+30) = (1500 + 1000)v$ $(+120000) + (+30000) = 2500 \times v$ $150000 = 2500v$ $v = \frac{+150000}{2500} = +60\,km\,h^{-1}\ [same\,direction\,(+)\,as\,initially]$ Note that we can leave the speeds in km/h as the conversion factor to m/s would cancel out on both sides.
4	$Ft = \Delta p$ $F = \frac{\Delta p}{t}$ $y = x$ (linear, and directly proportional)

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	Note that the other straight-line (linear) graph has a y-intercept so is in the form of y = mx + c. It is not directly proportional as it does not pass through the origin.
5	$a = \frac{v-u}{t} = \frac{30-5}{12} = 2.08\,m\,s^{-2}$ $F = ma = 900 \times 2.08 = 1875\,N$

Chapter 12 Review – Extend

Q	Reason
1	$p_i = p_f$ $m_1u_1 + m_2u_2 = (m_1 + m_2)v\ [coupled\,\&\,inelastic]$ $m_{you} \times 0 + m_{ball}u_2 = (m_{you} + m_{ball})v_{you+ball}$ $m_{you} \times 0 + (0.1 \times m_{you}u_{ball}) = (m_{you} + \frac{1}{10}m_{you})v_{you+ball}$ $0.1 \times m_{you}u_{ball} = (1.1m_{you})v_{you+ball}$ $0.1 \times u_{ball} = 1.1v_{you+ball}$ $v_{you+ball} = \frac{0.1 \times u_{ball}}{1.1}$ $v_{you+ball} = \frac{1}{11}u_{ball}$
2	$p_i = p_f$ $\Delta p = p_f - p_i = 0$ We do not need to do a calculation as the law of conservation of momentum applies and the change in momentum is zero.
3	$Ft = \Delta p$ $= \frac{m(v-u)}{t}$ $= \frac{0.200 \times (0-30)}{0.10}$ $= 60\,N$ Note: students often want to know how many significant figures are in a term like "one-tenth of a second". That is, is it 0.1 s (1 sf) or 0.10 s (2 sf). The answer is that we can't be sure. It is not a useful way of describing the significance of a number. I would say it means 0.10 as "ten" means 10, and not 9 or 11 so the trailing zero in 10 is significant, thus "ten" has 2 sf, and so one-tenth has 2 sf as well.

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4	$p_i = p_f$ $m_R u_R + m_B u_B = p_f$ $-10000 + (+20000) = p_f$ (let east be the + direction) $+10000 = p_f$ (east as it is in the + direction) $p_f = 10000\,\text{kg m s}^{-1}$ east
5	$p_i = p_f$ $(m_1 + m_2)u = m_1 v_1 + m_2 v_2$ $(m_{man+coat})u = m_{man} v_{man} + m_{coat} v_{coat}$ $102 \times 0 = 100 v_{man} + 2 \times 25$ $0 = 100 v_{man} + 50$ $v_{man} = \frac{-50}{100} = -0.5\,m\,s^{-1}$ $speed = 0.5\,m\,s^{-1}$ Note that question only asks for speed, so the direction is not required. An alternative understanding of the data would have the mass of the (man + coat) = 100 kg, so the man is 98 kg and the coat 2 kg. The answer works out the same to one decimal place: $100 \times 0 = 98 v_{man} + 2 \times 25$ $0 = 98 v_{man} + 50$ $v_{man} = \frac{-50}{98} = -0.5\,m\,s^{-1}$