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Question 7 (Answer: **A**)

- Force is the rate of change of momentum, $F = \Delta p / \Delta t$.
- The momentum changes by $15\,000 - 10\,000 = 5000$ kg m/s.
- $F = 5000/8.0 = 630$ N.

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Question 6 (Answer: **C**)

- Momentum is conserved, so the total before the collision equals the total after.
- Take one direction as positive, which makes the opposing velocity negative.
- Total before $= 0.15(2.1) + m_Y(-0.4)$; set that equal to the total afterwards and solve.

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Question 8 (Answer: **B**)

- Impulse equals the change in momentum: $Ft = mv$.
- $200 \times 0.040 = 8.0$ kg m/s.
- The ball starts at rest, so $mv = 8.0$ – divide by the ball's mass to get its speed.

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2(a)	(–) 3.5 kgm / s
	(Δ*p* =) *m*(Δ)*u* **OR** *m*{*v* – *u*} **OR** 0.14 × {25 (– 0)}
2(b)	360 N
	0.0097 (s) **OR** 9.7 × 10^{-3} (s) **OR** 3.6 × 10^{n}
	(*F* =) (Δ)*p* / *t* **OR** 3.5 / 0.0097

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Question 6 (Answer: **C**)

- Momentum is a vector, so the direction matters.
- Taking downwards as positive, the momentum changes from $+mv_1$ to $-mv_2$.
- The change is $-mv_2 - mv_1$, whose magnitude is $m(v_1 + v_2)$ – the speeds add because the ball reverses.

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2(a)(i)	0.16 m / s
	conservation of momentum **OR** $m_P v_P = m_Q v_Q$ **OR** 2.7 × v_P = 1.2 × 0.36 **OR** ($m_Q v_Q$ =) 0.432 seen
	(v_P =) $m_Q v_Q$ / m_P **OR** 1.2 × 0.36 / 2.7
2(a)(ii)	0.078 J
	(k.e. =) ½*mv*^{2} **OR** (k.e. =) ½ × 1.2 × 0.36^2
	(k.e. =) ½ × 1.2 × 0.36^2
2(b)	(from) elastic (energy store in the compressed spring)
	to kinetic (as final energy store of trolleys)

Question 7 (Answer: **B**)

- Impulse equals the change in momentum, $Ft = \Delta(mv)$.
- X's momentum before the collision is $0.15 \times 2.0 = 0.30$ kg m/s.
- Momentum is conserved, so whatever X loses Y gains – the impulse on Y is the momentum transferred to it.

1(a)	20 J
	($\Delta.E_p$ =) $mg(\Delta)h$ **OR** $0.2(0)\times9.8\times10$
1(b)(i)	14 J
	(E_k =) ½mv^2 **OR** ½ × 0.2(0) × 12^2
1(b)(ii)	$p = mv$ **OR (**Δp =) $mv–mu$
	(Δp =) $0.2(0)\times\{14+12\}$ **OR** $0.2(0)\times\{14--12\}$ **OR** p_{before} = 0.2(0) × 14 **AND** p_{after} = 0.2(0) × (–)12
	(Δp =) $2.8-\{-2.4\}$ (= 5.2 kg m / s) **OR** (Δp =) $0.2(0)\times\{14--12\}$
1(b)(iii)	21 N
	(F =) Δp / (Δ)t **OR** $F = (\Delta)mv / (\Delta)t$ **OR** 5.2 / 0.25