Assessment schedule: practice paper 2026

AS 91171 Demonstrate understanding of mechanics · Vertex Academy practice paper, not an NZQA paper

QUESTION ONE

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	$a = 27 \div 9.0 = 3.0$ m s^{-2} $d = (0 + 27) \div 2 \times 9.0$ $d = 120$ m (121.5 m)	$a = 3.0$ m s^{-2} AND $d = 120$ m (121.5 m).		
(b)	$v = \sqrt{(1.5^2 + 2.0^2)} = 2.5$ m s^{-1} $\tan\theta = 2.0 \div 1.5$ $\theta = 53°$ downstream from straight across	2.5 m s^{-1} AND a correct direction (53° downstream from straight across, or 37° from the current).		
(c)	$1.8 = ½ \times 9.8 \times t^2$ $t = 0.606$ s $d = 4.0 \times 0.606 = 2.4$ m only force: weight, downwards horizontal v constant; vertical v increases	$t = 0.61$ s, OR states that there is no horizontal force.	Lands 2.4 m from the deck AND explains with forces: weight is the only force, acting down, so only the vertical velocity changes.	
(d)	$v_h = 18\cos 35° = 14.7$ m s^{-1}, $v_v = 18\sin 35° = 10.3$ m s^{-1} $t = 22 \div 14.7 = 1.49$ s $y = 10.3 \times 1.49 - 4.9 \times 1.49^2 = 4.5$ m $v_f = 10.3 - 9.8 \times 1.49 = -4.3$ m s^{-1} clears by 1.5 m, on the way down	Correct horizontal and vertical components (14.7 and 10.3 m s^{-1}).	Time to the posts (1.49 s) AND height there (4.5 m), so the ball clears the bar.	Height 4.5 m so it clears by about 1.5 m, AND shows it is falling ($v_f = -4.3$ m s^{-1}, or highest point at 1.05 s before 1.49 s).

QUESTION TWO

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	$F = 25 \times 9.8 = 245$ N $\tau = 245 \times 1.2$ $\tau = 290$ N m (294 N m)	$\tau = 290$ N m (294 N m).		
(b)	$a = v^2 \div r = 100 \div 20$ $a = 5.0$ m s^{-2}, towards the centre	$a = 5.0$ m s^{-2} AND towards the centre.		

(c)	torques about A: FB × 4.0 = 196 × 2.0 + 686 × 1.0 FB = 1078 ÷ 4.0 = 269.5 N FA + FB = 90 × 9.8 = 882 N FA = 612.5 N FA = 610 N, FB = 270 N	Correct weights (196 N and 686 N), OR a correct torque statement about one trestle.	Both support forces correct: FA = 610 N (612.5 N) AND FB = 270 N (269.5 N).	
(d)	centripetal force = sideways friction, towards the centre F = 1200 × 10² ÷ 20 = 6000 N 9000 = 1200 × v² ÷ 20 v = √150 = 12 m s⁻¹ faster: friction too small	F = 6000 N, OR names friction towards the centre as the centripetal force.	6000 N AND greatest speed 12 m s⁻¹ (12.2 m s⁻¹).	Greatest speed AND explains that above it the needed centripetal force (proportional to v²) exceeds the maximum friction, so the car slides wide, closer to the tangent (not thrown outwards).

QUESTION THREE

Part	Evidence	Achievement (u)	Merit (r)	Excellence (t)
(a)	k = F ÷ x k = 400 ÷ 0.050 = 8000 N m⁻¹	k = 8000 N m⁻¹ with a correct unit.		
(b)	Ep = ½kx² Ep = 0.5 × 8000 × 0.080² Ep = 26 J (25.6 J)	Ep = 26 J (25.6 J).		
(c)	p before = 95 × 6.0 − 80 × 4.0 = 250 kg m s⁻¹ p after = 175 × v v = 250 ÷ 175 = 1.4 m s⁻¹ equal and opposite forces for the same time v = 1.4 m s⁻¹ east	Total momentum 250 kg m s⁻¹, OR v with a wrong sign or direction.	v = 1.4 m s⁻¹ east AND explains conservation with equal and opposite forces (Newton's third law) and no significant outside force.	

(d)	Ek before = 1710 + 640 = 2350 J Ek after = ½ × 175 × 1.43² = 179 J lost Ek becomes heat, sound, deformation Δp = 80 × (1.43 + 4.0) = 434 kg m s^{-1} F = 434 ÷ 0.40 = 1100 N east	Correct kinetic energy before (2350 J) or after (179 J), OR Δp for one player.	Shows kinetic energy is lost (inelastic) with where it goes, OR the average force 1100 N.	Inelastic shown with both energies and where the energy goes, AND the average force on the 80 kg player 1100 N (1086 N) east.

Judgement for each question

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a.	2a, or 1m.	3a, or 1a and 1m.	4a, or 2a and 1m.	2m, or 1e.	2a and 2m, or 1m and 1e.	1e and 1m, with a minor error or omission elsewhere.	2a, 1m and 1e: every part correct.

Grade score out of 24 (each question's grade: N0 = 0 to E8 = 8): Not Achieved 0 to 7, Achieved 8 to 13, Merit 14 to 18, Excellence 19 to 24 (the 2025 exam's cut scores).