

- 1 (a) (i) 1. force marked towards centre B1
 2. force marked towards centre B1
- (ii) 1. clearly horizontal at start to left or right M1
 horizontal to the left curving down to reach ground to left of A B1
 2. vertically down, not necessarily to reach ground B1
- (b) Allow use of $g = 9.81$ or 9.8 throughout
- (i) 0.5 N B1
- (ii) 4.1 N or 3.1 N e.c.f. from (i) C1
 4.1 N e.c.f. from (i) A1

[8]

- 2 (a) (i) any mention of force or weight ignore mass C1
 Force to left > force to right)
 OR resultant force) any 1 A1
 OR unbalanced force)
 OR weight > friction)
- (ii) to overcome/compensate for friction/resistance B1
- (b) $2/2.5$ or $4/5$ etc. or F/a or $F = ma$ C1
 0.8 kg
- (c) 0.7/0.8 e.c.f. from (b) B1
 0.875 (m/s^2) e.c.f. from (b) could be scored on table (no unit needed) B1
- (d) (i) $v = at$ or 0.5×1.2 C1
 0.6 m/s
- (ii) any velocity \times time or speed \times time C1
 0.36 m c.a.o. (note: 0.72 m gets C1, A0) A1 [11]

3	(a)	two masses chosen with ratio 2:1 or 3:1 or 3:2 chosen masses in correct holes to balance	M1 A1	
	(b)	disc does not rotate/is balanced/in equilibrium/no movement NOT spin the disc NOT anything to do with calculating moments NOT when disturbed, returns to original position	B1	
	(c)	moment of one mass correct (ignore units) accept mass × distance calculated equal answers	B1 B1	
	(d)	correct addition of masses/weights, including 200g any mass correctly converted to N	B1 B1	[7]
4	(a)	(i) straight arrow towards centre, by eye	B1	[1]
		(ii) force larger	B1	[1]
	(b)	(i) straight arrow along tangent at P clockwise, by eye	B1	[1]
		(ii) <u>friction</u> between tyres and track provide centripetal force	B1	
		<u>friction</u> too small (to provide required force)	B1	[2]
	(c)	(i) constant speed/velocity OR uniform motion OR no acceln. NOT constant motion	B1	[1]
		(ii) $(3 \times 25)/2 + (7 \times 25)$ OR area under graph	C1	
		212.5 cm any no s.f. ≥ 2	A1	[2]
		(iii) 25/3 or increase in speed/time	C1	
		8.33 cm/s any no s.f. ≥ 2 OR $8\frac{1}{3}$ cm/s accept cm/s^2	A1	[2]
				[Total: 10]

- 5 (a) moment of W down/anticlockwise, moment of steam opposite C1
 when moment of steam > moment of W, steam escapes
 OR when clockwise moment > anticlockwise moment, steam escapes A1 [2]
- (b) (i) $12 = 0.2 F$ C1
 $F = 60 \text{ N}$ c.a.o. allow 60–61 for ans if working for 60 N shown A1 [2]
- (ii) $(P =) F/A$ or $60/0.0003$ e.c.f. C1
 $2 \times 10^5 \text{ Pa}$ or $200\,000 \text{ Pa}$ e.c.f. (accept N/m^2) OR 20 N/cm^2 A1 [2]

[Total: 6]