Topic X3 Mechanics AS (Pre-TT A) [60] MARKSCHEME

1.

40 cos35°	B1			
WD = 40cos35° x 100	M1			
3280 J	A1	3	ignore units	3

2.

$v^2 = 2gh$	M1		kinematics or energy	2
$u=\sqrt{4g}$ or $\sqrt{39.2}$ or 6.26	A1		speed of impact (±)	
$v=\sqrt{2.8g}$ or $\sqrt{27.44}$ (5.24)	A1		speed of rebound (±)	
I =? 0.3(6.26 + 5.24)	M1		must be sum of mags. of vels.	
3.45 Ns	A1✓	5	✓ must be positive	5

3.

Question	Scheme	Marks	AOs
7(a)	Energy Loss = KE Loss – PE Gain	M1	3.3
	$= \frac{1}{2} \times 0.5 \times 25^2 - 0.5g \times 20$	A1	1.1b
	$= 58.25 = 58$ (J) or 58.3 (J)	A1	1.1b
		(3)	
(b)	Using work-energy principle, $20R = 58.25$	M1	3.3
	$R = 2.9125 = 2.9$ or 2.91	A1ft	1.1b
		(2)	
(c)	Make resistance variable (dependent on speed)	B1	3.5c
		(1)	
			(6 marks)

4.

(a)	Shows that c = 0 by considering the dimensions of mass and deduces that the speed does not depend on the density of the liquid	AO2.2a	M1	$LT^{-1} = (LT^{-2})^a \times L^b \times (MT^{-3})^c$ $0 = c$
	Rejects David's model because speed is shown not to depend on density	AO2.3	A1	Since c = 0, v does not depend on the density of the liquid. So David's model is incorrect.
(b)	Uses dimensions to form an equation for dimensional consistency.	AO1.1a	M1	$LT^{-1} = (LT^{-2})^a \times L^b$ $1 = a + b$ $-1 = -2a$ $a = \frac{1}{2}$
	Obtains correct values for a and b.	AO1.1b	A1	$b = \frac{1}{2}$
	Total		**4**	

5.

(i)	$D = 3000/5^2 = 120$	M1			
		A1	2	AG	
(ii)	$120 - 75 = 100a$	M1			
	$a = 0.45\ ms^{-2}$	A1	2		
(iii)	100x9.8x1/98	B1		weight component	
	$3000/v^2 = 3v^2 + 100x9.8x1/98$	M1			
	$3000 = 3v^4 + 10v^2$	A1		aef	
	solving quad in v^2	M1		($v^2 = 30$)	
	$v = 5.48\ ms^{-1}$	A1	5	accept $\sqrt{30}$	**9**

6.

(i)	$6m = 3mx + 2my$	M1		- 3mx ok if clear on diagram	
	$6 = 3x + 2y$	A1		m must have been cancelled	
	$e = 1 = (y-x)/2$	M1		or $\frac{1}{2}.3m.2^2 = \frac{1}{2}.3mx^2 + \frac{1}{2}.2my^2$	
		A1		$6 = 3x^2/2 + y^2$ aef	
	x = 0.4 or 2/5	A1		sc A1A0 if x = 2, y = 0 not rejected	
	y = 2.4 or 12/5	A1	6		
(ii)	4.8m or 24m/5	B1√		√ 2m x their y or 3m(2-their x)	
	same as original dir. of A	B1	2	use their diagram(or dir. of B)	
(iii)	$e = (2.8 - 1.0)/2.4$	M1			
	0.75 watch out for ± fiddles	A1√	2	√(1.8/their y) with 0 ≤ e < 1	**10**

7.

(i)	M1		For use of conservation of energy
$0.5x0.3v^2 - 0.5x0.3x2^2 = 0.3x9.8x0.5\cos 60 - 0.3x9.8x0.5\cos\theta$	A2,1,0		-1 each error
$v^2 = 8.9 - 9.8\cos\theta$	A1	[4]	AG
(ii)	M1		For using Newton's 2nd law radially
$T + 0.3x9.8\cos\theta = 0.3v^2/0.5$	A1		
$T + 2.94\cos\theta = 0.6(8.9 - 9.8\cos\theta)$	M1		For correct substitution for v^2
Tension is $(5.34 - 8.82\cos\theta)$N	A1	[4]	Accept any correct form
(iii)	M1		For using T = 0
Basic value $\theta = 52.7°$	A1 ft		ft any T of the form $a - b\cos\theta$
Angle = (360-52.7) - 60	M1		
Angle turned through is 247°	A1	[4]	

8.

(i)	T = 4.9 N	B1		B0 for 0.5g	**6**
	$T = 0.3 \times 0.2 \times \omega^2$	M1		or $0.3v^2/0.2$ and $\omega = v/0.2$	
		A1			
	$\omega = 9.04\ rads^{-1}$	A1	4		
(ii)	$\cos\theta = \sqrt{0.6}/0.8$ (0.968)	B1		(θ=14.5°) angle to vert. or equiv.	
	$T\cos\theta = 0.5 \times 9.8$	M1		angle consistent with diagram	
		A1		can be their angle	
	T = 5.06 N	A1	4		
(iii)	$T\sin\theta = 0.5 \times v^2/0.2$	M1		must be a component of T	
		A1		($\sin\theta$ = ¼) can be their angle	
	$v = 0.711\ ms^{-1}$	A1	3		**11**